Shipping Sheep A Zooarchaeology of Greek Colonisation

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This dissertation is submitted for the degree of Doctor of Philosophy

Department of Archaeology University of Cambridge For Cleo, who first fostered my interest in domesticates

ζ.

Declaration of Original Research and Intent

This thesis is the result of my own work and includes nothing which is the outcome of work undertaken in collaboration except where specifically indicated in the text.

Statement of Length

This thesis does not exceed the word or page limits as stipulated by the Degree Committee for the Division of Archaeology.

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Abstract

The process and impact of Greek colonisation in the Mediterranean have long been the subject of debate amongst classicists and archaeologists. The outcome of this debate remains a conflicting series of arguments for or against the level of organisation in the process of colonisation, as well as the interactions between colonists and native populations in the colonial environment. Theories of hybrid cultural interaction as opposed to the more traditional view of 'hellenization', or cultural dominance and subjugation are examined; along with arguments for and against evidence for the organization of colonial foundation and settlement.

This study examines the process of Greek colonisation in two areas of the central Mediterranean (Magna Graecia and central Dalmatia) through the identification of Greek varieties of sheep and cattle and their movements with colonisation. This investigation into livestock translocation with colonisation takes the form of two themes: (a) the hypothesized identification of regional or cultural varieties of domesticated animals through their remains from archaeological sites; and (b) what the movement and changes of domesticate varieties can tell us about the process of Greek colonisation in the study areas. Several researchers of the last few decades in zooarchaeology have compared the size and shape of domesticated animals either from sites of a region, or between periods of a site to examine changes or similarity in the biometry of their remains. Few biometric studies have considered livestock varieties, their uniformity and their identification. Despite arguments for 'enlarged' Greek livestock, no such studies have been done for Greece.

The study consists of three parts. The first part details the archaeological evidence for trade and the process of colonisation in the two study areas, followed by a discussion of changes in Greece between the Archaic (Magna Graecia) and Hellenistic (Dalmatia) periods of colonisation. Evidence for the existence of ancient livestock varieties is considered, along with examples of the means by which they may be distinguished. The second part of this study identifies Greek varieties of sheep and cattle through a comparison of domesticate biometric data from sites in ancient Greece. Domesticate biometry is also examined from indigenous sites prior to and during the period of colonisation in both southern Italy and central Dalmatia to determine if domesticate varieties can be identified in these areas, and distinguished from Greek livestock. In the third part, these biometric data are compared with those of colony sites in the study areas to determine if all colony sites in an area or period demonstrated a uniform pattern of livestock translocation, and for any faunal/biometric evidence for interaction between Greek and indigenous sites in the colonial environment.

The study determined that sheep (*Ovis aries*) from sites of Greece formed a discrete biometric cluster in both size and shape which could be clearly distinguished from those of indigenous (pre-colonisation) sites of both Magna Graecia and Dalmatia. The (less numerous) measures for cattle (*Bos taurus*) were similarly found to form a discrete biometric cluster for Greece distinct from those cattle of indigenous pre-colonisation sites. Indigenous sites in the colonisation areas contained their own discrete varieties of sheep and cattle. A statistically significant grouping was found for sites of Greece, as well as for indigenous sites of each study area. Biometric data for colonies of southern Italy displayed consistent (and statistically significant) evidence for the relocation of sheep and cattle, as well as evidence for mixing of Greek and indigenous live-stock varieties in both individual colony and indigenous (post-colonisation) sites. In the later (Hellenistic) and therefore putatively state-organized (in foundation) colonies of central Dalmatia, evidence for livestock translocation was found to be far less consistent, particularly in the early phases of colonisation. This study therefore shows not only that ancient domesticate varieties can be identified and distinguished between cultures. The arguments for state (polis) development and organization in Greece are of less importance in an understanding of colonisation than the individual local settings of the colonies themselves.

Contents

1	Intr	oduction: Zooarchaeology and the Quest for Colonisation	1
2	Hist	orical Background	8
	2.1	The Late Bronze Age: Collapse and Dark Ages	10
		2.1.1 Pre-Colonisation Italy: the Later Bronze Age	13
		2.1.2 The Eastern Adriatic Before Greek Colonization	17
		2.1.3 Pre-Colonisation Italy - 1100-800 BC	21
	2.2	New Neighbours: Greek Settlement	22
		2.2.1 Initial Greeks in Italy	28
		2.2.2 The Classical (600-400 BC) and Hellenistic (400-229 BC) Periods	30
3	Hist	ory, Identity and Being Greek	36
	3.1	On Being 'Greek'	36
	3.2	Two Greeces: Changes from the Archaic to Hellenistic Periods	46
4	Colo	onisation: Approach and Process	55
	4.1	What is a Colony?	55
		4.1.1 Colonies: Origin of the Term and Theoretical Confusion with Roman <i>Colo</i> -	
		niae	59
	4.2	The Colonial Environment: The Concept of 'Hellenization'	60
	4.3	Greek Settlement Abroad: a Theoretical Approach to Colonisation and Interactions	63
5	Bon	es of Clay: Animals as Material Culture	67
	5.1	On the Importance of Biometry	70
	5.2	Metric Changes: 'Improvements' or Movements?	75
	5.3	Greek Farming and Stock Raising	78
6	Site	Descriptions and Methodology	81
	6.1	The Approach	81
	6.2	Sample Requirements	83
	6.3	Recording Techniques and Criteria	85
		6.3.1 Identification	85
		6.3.2 Quantification	87
		6.3.3 Age Profiles	88
		6.3.4 Biometric Data	89

	6.4	The Sit	es	90
		6.4.1	Sites of Greece	90
		6.4.2	Colony Sites of Southern Italy and Sicily	94
		6.4.3	Indigenous Sites of Southern Italy and Sicily	98
		6.4.4	Colony and Indigenous Sites of Dalmatia	102
7	Size	Matters	: The Quest for 'Greek' Taxa	106
	7.1	Taxono	mic Distributions of Greek and Indigenous Sites	108
	7.2	Herd M	anagement: Age-at-Death Profiles	111
	7.3	Signific	ance of Size and Shape: Biometric Data and 'Greek' taxa	113
		7.3.1	Teeth	113
		7.3.2	Comparisons of Height	116
		7.3.3	Univariate Comparisons of Proportions	121
		7.3.4	Dimensions of Measure: Bivariate Analysis of Greek Livestock	126
8	The	Shane o	f Things That Come: Greek Taxa and Colonisation	150
Ū	8.1	Domesi	icates. Translocation and Southern Italy	151
	8.2	Domes	icates, Translocation and Central Dalmatia	173
	83	Summa	ry of Findings	185
	0.0			100
9	Sum	imary ai	nd Conclusions: A Zooarchaeology of Greek Colonisation	188
9 A	Sum Site	imary ai Taxonoi	nd Conclusions: A Zooarchaeology of Greek Colonisation	188 220
9 A B	Sum Site	imary ai Taxonoi	nd Conclusions: A Zooarchaeology of Greek Colonisation nic and Age Distributions	188 220 229
9 A B	Sum Site Univ	imary ai Taxonoi variate A	ad Conclusions: A Zooarchaeology of Greek Colonisation nic and Age Distributions analyses ate Analyses for Bos taurus	 188 220 229 231
9 A B	Sum Site Univ B.1 B 2	imary an Taxonoi variate A Univari	ad Conclusions: A Zooarchaeology of Greek Colonisation nic and Age Distributions nalyses ate Analyses for <i>Bos taurus</i>	 188 220 229 231 240
9 A B	Sum Site Univ B.1 B.2 B 3	Taxonor Taxonor variate A Univari Univari	ad Conclusions: A Zooarchaeology of Greek Colonisation nic and Age Distributions nalyses ate Analyses for <i>Bos taurus</i>	 188 220 229 231 240 250
9 A B	Sum Site Univ B.1 B.2 B.3 B.4	mary an Taxonoi variate Univari Univari Univari	ad Conclusions: A Zooarchaeology of Greek Colonisation nic and Age Distributions nalyses ate Analyses for <i>Bos taurus</i>	 188 220 229 231 240 250 256
9 A B	Sum Site Univ B.1 B.2 B.3 B.4	Taxonor Variate Univari Univari Univari Univari	ad Conclusions: A Zooarchaeology of Greek Colonisation nic and Age Distributions nalyses ate Analyses for <i>Bos taurus</i>	 188 220 229 231 240 250 256
9 A B	Sum Site Univ B.1 B.2 B.3 B.4 Biva	Taxonoi Variate Univari Univari Univari Univari	ad Conclusions: A Zooarchaeology of Greek Colonisation nic and Age Distributions analyses ate Analyses for Bos taurus	 188 220 229 231 240 250 256 264
9 A B	Sum Site Univ B.1 B.2 B.3 B.4 Biva C.1	Taxonor Variate Univari Univari Univari Univari Bivaria	ad Conclusions: A Zooarchaeology of Greek Colonisation nic and Age Distributions analyses ate Analyses for Bos taurus ate Analyses of Ovis aries ate Analyses for Capra hircus ate Analyses for Sus domesticus alyses te Graphs of Bos taurus	 188 220 229 231 240 250 256 264 264
9 A B	Sum Site Univ B.1 B.2 B.3 B.4 Biva C.1 C.2	Taxonoi Variate Univari Univari Univari Univari Divaria Bivaria Bivaria	ad Conclusions: A Zooarchaeology of Greek Colonisation nic and Age Distributions nalyses ate Analyses for Bos taurus ate Analyses of Ovis aries ate Analyses for Capra hircus ate Analyses for Sus domesticus alyses te Graphs of Bos taurus te Graphs of Ovis aries	 188 220 229 231 240 250 256 264 264 271
9 A B C	Sum Site Univ B.1 B.2 B.3 B.4 Biva C.1 C.2 C.3	Taxonor Variate A Univari Univari Univari Univari Bivaria Bivaria Bivaria	ad Conclusions: A Zooarchaeology of Greek Colonisation nic and Age Distributions analyses ate Analyses for Bos taurus ate Analyses of Ovis aries ate Analyses for Capra hircus ate Analyses for Sus domesticus	 188 220 229 231 240 250 256 264 264 271 279
9 A B C	Sum Site Univ B.1 B.2 B.3 B.4 Biva C.1 C.2 C.3 C.4	Taxonor variate A Univari Univari Univari Univari Bivaria Bivaria Bivaria Bivaria	ad Conclusions: A Zooarchaeology of Greek Colonisation nic and Age Distributions analyses ate Analyses for Bos taurus ate Analyses of Ovis aries ate Analyses for Capra hircus ate Analyses for Sus domesticus te Graphs of Bos taurus ate Graphs for Capra hircus ate Graphs for Sus domesticus	 188 220 229 231 240 250 256 264 264 271 279 284
9 A B C	Sum Site Univ B.1 B.2 B.3 B.4 Biva C.1 C.2 C.3 C.4 Stat	Taxonor Variate A Univari Univari Univari Univari Bivaria Bivaria Bivaria Bivaria	ad Conclusions: A Zooarchaeology of Greek Colonisation nic and Age Distributions analyses ate Analyses for Bos taurus ate Analyses for Capra hircus ate Analyses for Sus domesticus te Graphs of Bos taurus ate Graphs for Capra hircus ate Graphs for Capra hircus	 188 220 229 231 240 250 256 264 264 271 279 284 291
9 A B C	Sum Site Univ B.1 B.2 B.3 B.4 Biva C.1 C.2 C.3 C.4 Stat D 1	Taxonor variate A Univari Univari Univari Univari Bivaria Bivaria Bivaria Bivaria	ad Conclusions: A Zooarchaeology of Greek Colonisation nic and Age Distributions analyses ate Analyses for Bos taurus ate Analyses for Capra hircus ate Analyses for Sus domesticus ate Graphs of Bos taurus ate Graphs for Capra hircus ate Graphs for Sus domesticus ate Graphs for Sus domesticus	 188 220 229 231 240 250 256 264 264 271 279 284 291
9 A B C	Sum Site Univ B.1 B.2 B.3 B.4 Biva C.1 C.2 C.3 C.4 Stat D.1 D 2	Taxonor Variate A Univari Univari Univari Univari Bivaria Bivaria Bivaria Bivaria Sitical A Statistic	ad Conclusions: A Zooarchaeology of Greek Colonisation nic and Age Distributions analyses ate Analyses for Bos taurus ate Analyses of Ovis aries ate Analyses for Capra hircus ate Analyses for Sus domesticus ate Graphs of Bos taurus ate Graphs for Capra hircus ate Graphs for Capra hircus ate Graphs for Sus domesticus ate Graphs for Capra hircus ate Graphs for Capra hircus	 188 220 229 231 240 250 256 264 264 271 279 284 291 303

List of Figures

2.1	Overall map of the study area	9
2.2	Principal regions of ancient Greece	10
2.3	Map of Greece and Albania showing sites mentioned in this chapter	11
2.4	Finds of Mycenaean pottery in the Adriatic and Ionian regions	15
2.5	Map showing sites in Italy mentioned in this chapter.	16
2.6	Map showing sites in central Dalmatia mentioned in this chapter.	19
2.7	Distribution of amber beads in the Adriatic and Ionian regions	20
2.8	Distribution of violin-bow fibulae in the Adriatic and Ionian regions	21
2.9	Finds of coins from 'Heraclea with a port'	32
3.1	Principal regions of ancient Greece	38
3.2	Map showing sites of Greece, Albania and Sicily relating to discussions in this	
	chapter of the Persian and Peloponnesian Wars.	47
3.3	Poleis of the Delian League and the Peloponnesian League and their allies	49
5.1	Height estimate examples for basenji and basset hound	72
5.2	Location of the Lelantine War	79
6.1	Sites of Greece in the study	90
6.2	Sites of southern Italy and Sicily in the study	95
6.3	Sites of central Dalmatia in the study	102
7.1	Domesticate taxonomic distribution of sites in the study	110
7.2	Culling profiles of <i>Ovis aries</i> from Greek sites	111
7.3	Bos taurus M_3 length comparison $\ldots \ldots \ldots$	115
7.4	Ovis aries M_3 length comparison	115
7.5	Sus domesticus M_3 length comparison $\ldots \ldots \ldots$	116
7.6	Height estimates for <i>Bos taurus</i>	117
7.7	Height estimates for Ovis aries	118
7.8	Height estimates for <i>Capra hircus</i>	119
7.9	Height estimates for <i>Sus domesticus</i>	120
7.10	Astragali length from <i>Bos taurus</i> of all sites	122
7.11	Astragali length from Ovis aries of all sites	123
7.12	Radius proximal breadth from <i>Capra hircus</i> of all sites	124
7.13	Tibia distal breadth from <i>Sus domesticus</i> of all sites	125
7.14	Astragali length and breadth from Bos taurus of Greek (with Kastanas) and indige-	
	nous pre-colonisation sites	128

7.15	Astragali length and breadth from Bos taurus of Greek (without Kastanas) and	
	indigenous pre-colonisation sites	129
7.16	Astragali length, breadth and depth from <i>Bos taurus</i> of Greek and indigenous south-	
	ern Italian sites	130
7.17	Bivariate shape analysis of LSI length and proximal breadth of <i>Bos taurus</i>	133
7.18	Bivariate shape analysis of LSI of length and proximal breadth of Bos taurus, ex-	
	cepting Kastanas	134
7.19	Mean LSI values for length and proximal breadth of <i>Bos taurus</i> for Greek sites and	
	indigenous sites of southern Italy	135
7.20	Bivariate comparison of measures of length and breadth of Ovis aries astragali from	
	Greek and indigenous sites	137
7.21	Bivariate comparison of measures of distal breadth and depth of Ovis aries tibiae	
	from Greek and indigenous sites	138
7.22	LSI values of bivariate shape analysis of <i>Ovis aries</i> indices of length and breadth	
	from Greek sites, indigenous sites of southern Italy and of central Dalmatia	140
7.23	Mean LSI values of bivariate shape analysis of Ovis aries indices of length and	
	breadth from Greek sites, indigenous sites of southern Italy and of central Dalmatia	141
7.24	LSI comparison of proximal breadth and depth of all elements for <i>Ovis aries</i> from	
	Greek and southern Italian indigenous sites	142
7.25	Comparison of distal breadth and depth of <i>Capra hircus</i> tibiae from sites of Greece	
	and indigenous sites of southern Italy and central Dalmatia	143
7.26	Comparison of length and proximal breadth of <i>Capra hircus</i> first phalanx from sites	
	of Greece and indigenous sites of southern Italy and central Dalmatia	143
7.27	Comparison of proportional LSI values for length and proximal breadth of <i>Capra</i>	
	<i>hircus</i> of Greek and earlier indigenous southern Italian sites	146
7.28	Comparison of length and breadth of <i>Sus domesticus</i> astragali for sites of Greece	
	and indigenous sites of southern Italy and central Dalmatia	147
7.29	Comparison of distal breadth and depth of Sus domesticus tibiae from sites of	
	Greece and indigenous sites of southern Italy and central Dalmatia	147
7.30	Bivariate comparison of proportion LSI values of length and proximal breadth for	
	Sus domesticus of Greek and earlier indigenous southern Italian sites	148
	C	
8.1	Comparison of length and breadth of Bos taurus astragali for Greek sites and in-	
	digenous and colony sites of southern Italy and Sicily	152
8.2	Comparison of breadth and depth of Bos taurus distal tibia of indigenous and	
	colony sites of southern Italy and Sicily	153
8.3	Plot of length and proximal breadth LSI values of Bos taurus for Greek sites (with	
	Kastanas) and indigenous and colony sites of southern Italy	157
8.4	Plot of mean length and proximal breadth LSI values of Bos taurus for Greek sites	
	and indigenous and colony sites of southern Italy	158
8.5	Plot of LSI values of breadth and depth of Bos taurus from Greek sites and indige-	
	nous and colony sites of southern Italy	159
8.6	Plot showing mean proximal breadth and depth LSI values of Bos taurus from	
	Greek sites and indigenous and colony sites of southern Italy	160

8.7	Astragalus length and bread of <i>Ovis aries</i> of Greek sites and indigenous and colony sites of southern Italy	161
8.8	Astragalus length and breadth of <i>Ovis aries</i> of indigenous and colony sites of southern Italy	163
8.9	Tibia distal breadth and depth of <i>Ovis aries</i> from sites of Greece and indigenous and colony sites of southern Italy	163
8.10	Tibia distal breadth and depth of <i>Ovis aries</i> from indigenous and colony sites of southern Italy	165
8.11	LSI comparison of length and proximal breadth of <i>Ovis aries</i> from sites of Greece	160
8.12	Mean LSI comparison of length and proximal breadth of <i>Ovis aries</i> from Greek	160
8.13	Mean LSI comparison of proximal breadth and depth of <i>Ovis aries</i> for Greek sites	109
8.14	Comparison of LSI values for length and proximal breadth of <i>Capra hircus</i> from	170
8.15	LSI value comparison of length and proximal breadth of <i>Sus domesticus</i> from	171
8 16	Greek and southern Italian indigenous sites	172
8 17	Astragali length and denth for <i>Bos taurus</i> of Greece and central Dalmatia	174
8 18	First phalanx length and breadth for <i>Bos taurus</i> of Greece and central Dalmatia	175
8 19	I SI comparison of length and provimal breadth for <i>Bos taurus</i> of Greece and cen-	175
0.17	tral Dalmatia	176
8.20	LSI comparison of proximal breadth and depth for <i>Bos taurus</i> of Greece and central	170
	Dalmatia	177
8.21	Tibia distal breadth and depth for Ovis aries of Greece and central Dalmatia	179
8.22	Astragalus length and breadth for <i>Ovis aries</i> of Greece and central Dalmatia	180
8.23	Mean LSI values for length and proximal breadth of <i>Ovis aries</i> of Greece and central Dalmatia	181
8.24	Mean LSI values for proximal breadth and depth of <i>Ovis aries</i> of Greece and central	101
8.25	Mean LSI values for distal breadth and depth of <i>Ovis aries</i> of Greece and central	182
	Dalmatia	183
A.1	Culling profiles for <i>Ovis aries</i> of sites in Dalmatia	227
B .1	Lengths of M^3 for <i>Bos taurus</i> \ldots \ldots \ldots \ldots \ldots \ldots \ldots	229
B.2	Lengths of M^3 for Ovis aries	230
B.3	Lengths of M^3 for Sus domesticus $\ldots \ldots \ldots$	230
B.4	Breadth comparisons of scapula glenoid fossa for <i>Bos taurus</i>	231
B.5	Breadth comparisons of humerus trochlea for <i>Bos taurus</i>	231
B.6	Breadth comparisons of proximal radius for <i>Bos taurus</i>	232
B.7	Breadth comparisons of distal radius for <i>Bos taurus</i>	232
B.8	Length comparisons of metacarpal for <i>Bos taurus</i>	233
B.9	Breadth comparisons of proximal metacarpal for <i>Bos taurus</i>	233

B. 10	Depth comparisons of proximal metacarpal for <i>Bos taurus</i>	234
B. 11	Length comparisons of metatarsal for <i>Bos taurus</i>	234
B.12	Breadth comparisons of proximal metatarsal for <i>Bos taurus</i>	235
B.13	Depth comparisons of proximal metatarsal for <i>Bos taurus</i>	235
B .14	Length comparisons of astragalus for <i>Bos taurus</i>	236
B.15	Breadth comparisons of astragalus for <i>Bos taurus</i>	236
B.16	Depth comparisons of astragalus for <i>Bos taurus</i>	237
B. 17	Breadth comparisons of distal tibia for <i>Bos taurus</i>	237
B.18	Depth comparisons of distal tibia for <i>Bos taurus</i>	238
B.19	Length comparisons of first phalanx for <i>Bos taurus</i>	238
B.20	Breadth comparisons of proximal first phalanx for Bos taurus	239
B.21	Breadth comparisons of humerus trochlea for Ovis aries	240
B.22	Breadth comparisons of glenoid fossa of scapula for Ovis aries	240
B.23	Length comparisons of metacarpal for Ovis aries	241
B.24	Breadth comparisons of proximal metacarpal for Ovis aries	241
B.25	Length comparisons of radius for <i>Ovis aries</i>	242
B.26	Breadth comparisons of proximal radius for Ovis aries	242
B.27	Depth comparisons of proximal radius for Ovis aries	243
B.28	Breadth comparisons of distal radius for Ovis aries	243
B.29	Depth comparisons of distal radius for Ovis aries	244
B.30	Breadth comparisons of distal tibia for Ovis aries	244
B.31	Depth comparisons of distal tibia for Ovis aries	245
B.32	Length comparisons of metatarsal for Ovis aries	245
B.33	Breadth comparisons of proximal metatarsal for Ovis aries	246
B.34	Depth comparisons of proximal metatarsal for Ovis aries	246
B.35	Length comparisons of calcaneus for Ovis aries	247
B.36	Length comparisons of astragalus for Ovis aries	247
B.37	Breadth comparisons of astragalus for Ovis aries	248
B.38	Depth comparisons of astragalus for Ovis aries	248
B.39	Length comparisons of first phalanx for Ovis aries	249
B.40	Breadth comparisons of proximal first phalanx for Ovis aries	249
B. 41	Breadth comparisons of glenoid fossa of scapula for <i>Capra hircus</i>	250
B.42	Breadth comparisons of humerus trochlea for <i>Capra hircus</i>	250
B.43	Breadth comparisons of proximal radius for <i>Capra hircus</i>	251
B.44	Breadth comparisons of distal radius for <i>Capra hircus</i>	251
B.45	Breadth comparisons of proximal metacarpal for <i>Capra hircus</i>	252
B.46	Depth comparisons of proximal metacarpal for <i>Capra hircus</i>	252
B.47	Breadth comparisons of distal metatarsal for <i>Capra hircus</i>	253
B. 48	Breadth comparisons of distal tibia for <i>Capra hircus</i>	253
B.49	Length comparisons of astragalus for <i>Capra hircus</i>	254
B.50	Breadth comparisons of astragalus for <i>Capra hircus</i>	254
B.51	Length comparisons of first phalanx for <i>Capra hircus</i>	255
B.52	Breadth comparisons of proximal first phalanx for <i>Capra hircus</i>	255
B.53	Breadth comparisons of scapula glenoid fossa for Sus domesticus	256
B.54	Breadth comparisons of humerus trochlea for <i>Sus domesticus</i>	256

 B.56 Breadth comparisons of proximal third metacarpal for <i>Sus domesticus</i> B.57 Breadth comparisons of distal tibia for <i>Sus domesticus</i> B.58 Depth comparisons of distal tibia for <i>Sus domesticus</i> B.59 Length comparisons of proximal third metatarsal for <i>Sus domesticus</i> B.60 Breadth comparisons of proximal third metatarsal for <i>Sus domesticus</i> B.61 Breadth comparisons of proximal fourth metatarsal for <i>Sus domesticus</i> B.63 Breadth comparisons of astragalus for <i>Sus domesticus</i> B.64 Depth comparisons of astragalus for <i>Sus domesticus</i> B.65 Length comparisons of astragalus for <i>Sus domesticus</i> B.66 Depth comparisons of astragalus for <i>Sus domesticus</i> B.65 Length comparisons of calcaneus for <i>Sus domesticus</i> B.66 Length comparisons of first phalanx for <i>Sus domesticus</i> B.67 Breadth comparisons of proximal first phalanx for <i>Sus domesticus</i> C.1 Scapula glenoid fossa breadth and depth for <i>Bos taurus</i> C.2 Radius proximal breadth and depth for <i>Bos taurus</i> C.3 Metacarpal length and proximal breadth of <i>Bos taurus</i> C.4 Metacarpal distal breadth and depth of <i>Bos taurus</i> C.6 Tibia distal breadth and depth of <i>Bos taurus</i> C.7 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.8 Metacarpal length and proximal breadth of <i>Bos taurus</i> C.9 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.11 Radius proximal breadth and depth for <i>Ovis aries</i> C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.13 Metacarpal length and proximal breadth of <i>Bos taurus</i> C.14 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.14 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Meta	257 258 259 259 260 261 261 262 262 263 266 266 266 267 268 268 268 268
 B.57 Breadth comparisons of distal tibia for <i>Sus domesticus</i> B.58 Depth comparisons of third metatarsal for <i>Sus domesticus</i> B.69 Length comparisons of proximal third metatarsal for <i>Sus domesticus</i> B.60 Breadth comparisons of proximal fourth metatarsal for <i>Sus domesticus</i> B.61 Breadth comparisons of astragalus for <i>Sus domesticus</i> B.62 Length comparisons of astragalus for <i>Sus domesticus</i> B.63 Breadth comparisons of astragalus for <i>Sus domesticus</i> B.64 Depth comparisons of astragalus for <i>Sus domesticus</i> B.65 Length comparisons of calcaneus for <i>Sus domesticus</i> B.66 Length comparisons of first phalanx for <i>Sus domesticus</i> B.67 Breadth comparisons of proximal first phalanx for <i>Sus domesticus</i> B.68 Breadth comparisons of proximal first phalanx for <i>Sus domesticus</i> B.69 Breadth comparisons of proximal first phalanx for <i>Sus domesticus</i> B.60 Length comparisons of proximal breadth of <i>Bos taurus</i> C.1 Scapula glenoid fossa breadth and depth for <i>Bos taurus</i> C.2 Radius proximal breadth and depth of <i>Bos taurus</i> C.3 Metacarpal length and proximal breadth of <i>Bos taurus</i> C.4 Metacarpal distal breadth and depth of <i>Bos taurus</i> C.5 Metacarpal distal breadth and depth of <i>Bos taurus</i> C.6 Tibia distal breadth and depth of <i>Bos taurus</i> C.7 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.9 Metatarsal distal breadth and depth of <i>Bos taurus</i> C.1 Radius proximal breadth and depth of <i>Bos taurus</i> C.2 Radius proximal breadth and depth of <i>Bos taurus</i> C.4 Metacarpal proximal breadth and depth of <i>Bos taurus</i> C.5 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.6 Tibia distal breadth and depth of <i>Bos taurus</i> C.1 Radius proximal breadth and depth of <i>Bos taurus</i> C.1 Radius proximal breadth and depth of <i>Dovis aries</i> C.2 Metatarsal length and prox	258 259 259 260 261 261 262 262 263 266 266 267 267 268 268 268 269
 B.58 Depth comparisons of distal tibia for <i>Sus domesticus</i> B.59 Length comparisons of proximal third metatarsal for <i>Sus domesticus</i> B.60 Breadth comparisons of proximal fourth metatarsal for <i>Sus domesticus</i> B.61 Breadth comparisons of astragalus for <i>Sus domesticus</i> B.62 Length comparisons of astragalus for <i>Sus domesticus</i> B.63 Breadth comparisons of astragalus for <i>Sus domesticus</i> B.64 Depth comparisons of astragalus for <i>Sus domesticus</i> B.65 Length comparisons of astragalus for <i>Sus domesticus</i> B.66 Length comparisons of astragalus for <i>Sus domesticus</i> B.67 Breadth comparisons of proximal first phalanx for <i>Sus domesticus</i> B.67 Breadth comparisons of proximal first phalanx for <i>Sus domesticus</i> C.1 Scapula glenoid fossa breadth and depth for <i>Bos taurus</i> C.2 Radius proximal breadth and depth for <i>Bos taurus</i> C.3 Metacarpal length and proximal breadth of <i>Bos taurus</i> C.4 Metacarpal distal breadth and depth of <i>Bos taurus</i> C.5 Metacarpal distal breadth and depth of <i>Bos taurus</i> C.6 Tibia distal breadth and depth of <i>Bos taurus</i> C.7 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.9 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.10 First phalanx length and proximal breadth of <i>Bos taurus</i> C.11 Radius proximal breadth and depth for <i>Ovis aries</i> C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.14 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.14 Metacarpal len	258 259 260 261 261 262 262 262 263 266 266 267 267 267 268 268 268
 B.59 Length comparisons of third metatarsal for <i>Sus domesticus</i> B.60 Breadth comparisons of proximal third metatarsal for <i>Sus domesticus</i> B.61 Breadth comparisons of proximal fourth metatarsal for <i>Sus domesticus</i> B.62 Length comparisons of astragalus for <i>Sus domesticus</i> B.63 Breadth comparisons of astragalus for <i>Sus domesticus</i> B.64 Depth comparisons of astragalus for <i>Sus domesticus</i> B.65 Length comparisons of calcaneus for <i>Sus domesticus</i> B.66 Length comparisons of first phalanx for <i>Sus domesticus</i> B.67 Breadth comparisons of proximal first phalanx for <i>Sus domesticus</i> B.67 Breadth comparisons of proximal first phalanx for <i>Sus domesticus</i> C.1 Scapula glenoid fossa breadth and depth for <i>Bos taurus</i> C.2 Radius proximal breadth and depth of <i>Bos taurus</i> C.3 Metacarpal length and proximal breadth of <i>Bos taurus</i> C.4 Metacarpal proximal breadth and depth of <i>Bos taurus</i> C.5 Metacarpal distal breadth and depth of <i>Bos taurus</i> C.6 Tibia distal breadth and depth of <i>Bos taurus</i> C.7 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.8 Metatarsal proximal breadth and depth of <i>Bos taurus</i> C.9 Metatarsal distal breadth and depth of <i>Bos taurus</i> C.11 Radius proximal breadth and depth of <i>Bos taurus</i> C.2 Radius proximal breadth and depth of <i>Bos taurus</i> C.4 Metacarpal proximal breadth and depth of <i>Bos taurus</i> C.5 Metacarpal distal breadth and depth of <i>Bos taurus</i> C.6 Tibia distal breadth and depth of <i>Bos taurus</i> C.7 Metatarsal proximal breadth and depth of <i>Bos taurus</i> C.11 Radius proximal breadth and depth for <i>Ovis aries</i> C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovi</i>	259 259 260 261 261 262 262 262 263 266 267 267 267 268 268 268 269
 B.60 Breadth comparisons of proximal third metatarsal for <i>Sus domesticus</i> B.61 Breadth comparisons of proximal fourth metatarsal for <i>Sus domesticus</i> B.62 Length comparisons of astragalus for <i>Sus domesticus</i> B.63 Breadth comparisons of astragalus for <i>Sus domesticus</i> B.64 Depth comparisons of astragalus for <i>Sus domesticus</i> B.65 Length comparisons of calcaneus for <i>Sus domesticus</i> B.66 Length comparisons of proximal first phalanx for <i>Sus domesticus</i> B.67 Breadth comparisons of proximal first phalanx for <i>Sus domesticus</i> B.67 Breadth comparisons of proximal first phalanx for <i>Sus domesticus</i> C.1 Scapula glenoid fossa breadth and depth for <i>Bos taurus</i> C.2 Radius proximal breadth and depth for <i>Bos taurus</i> C.3 Metacarpal length and proximal breadth of <i>Bos taurus</i> C.4 Metacarpal proximal breadth and depth of <i>Bos taurus</i> C.5 Metacarpal distal breadth and depth of <i>Bos taurus</i> C.6 Tibia distal breadth and depth of <i>Bos taurus</i> C.7 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.8 Metatarsal proximal breadth and depth of <i>Bos taurus</i> C.9 Metatarsal distal breadth and depth for <i>Ovis aries</i> C.11 Radius proximal breadth and depth for <i>Ovis aries</i> C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.18 Astragalus length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.16 Metatarsal leng	259 260 261 261 262 262 263 266 266 267 267 268 268 268 268
 B.61 Breadth comparisons of proximal fourth metatarsal for <i>Sus domesticus</i> B.62 Length comparisons of astragalus for <i>Sus domesticus</i> B.63 Breadth comparisons of astragalus for <i>Sus domesticus</i> B.64 Depth comparisons of astragalus for <i>Sus domesticus</i> B.65 Length comparisons of calcaneus for <i>Sus domesticus</i> B.66 Length comparisons of first phalanx for <i>Sus domesticus</i> B.67 Breadth comparisons of proximal first phalanx for <i>Sus domesticus</i> C.1 Scapula glenoid fossa breadth and depth for <i>Bos taurus</i> C.2 Radius proximal breadth and depth for <i>Bos taurus</i> C.3 Metacarpal length and proximal breadth of <i>Bos taurus</i> C.4 Metacarpal proximal breadth and depth of <i>Bos taurus</i> C.5 Metacarpal distal breadth and depth of <i>Bos taurus</i> C.6 Tibia distal breadth and depth of <i>Bos taurus</i> C.7 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.8 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.9 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.10 First phalanx length and proximal breadth for <i>Ovis aries</i> C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.18 Astragalus length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal proximal breadth for <i>Ovis aries</i> C.16 Metatarsal proximal breadth for <i>Ovis aries</i> C.17 Metatarsal proximal breadth for <i>Ovis aries</i> C.18 Astragalus length and proximal breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i><td>260 261 261 262 262 263 266 266 267 267 268 268 268 268</td>	260 261 261 262 262 263 266 266 267 267 268 268 268 268
 B.62 Length comparisons of astragalus for Sus domesticus B.63 Breadth comparisons of astragalus for Sus domesticus B.64 Depth comparisons of astragalus for Sus domesticus B.65 Length comparisons of calcaneus for Sus domesticus B.66 Length comparisons of first phalanx for Sus domesticus B.67 Breadth comparisons of proximal first phalanx for Sus domesticus C.1 Scapula glenoid fossa breadth and depth for Bos taurus C.2 Radius proximal breadth and depth for Bos taurus C.3 Metacarpal length and proximal breadth of Bos taurus C.4 Metacarpal proximal breadth and depth of Bos taurus C.5 Metacarpal distal breadth and depth of Bos taurus C.6 Tibia distal breadth and depth of Bos taurus C.7 Metatarsal length and proximal breadth of Bos taurus C.8 Metatarsal proximal breadth and depth of Bos taurus C.9 Metatarsal length and proximal breadth of Bos taurus C.10 First phalanx length and proximal breadth of Bos taurus C.11 Radius proximal breadth and depth for Ovis aries C.12 Radius distal breadth and depth for Ovis aries C.13 Metacarpal length and proximal breadth for Ovis aries C.14 Metacarpal proximal breadth and depth for Ovis aries C.15 Tibia distal breadth and depth for Ovis aries C.16 Hetatarsal length and proximal breadth for Ovis aries C.17 Metatarsal length and proximal breadth for Ovis aries C.16 Hetatarsal length and proximal breadth for Ovis aries C.17 Metatarsal length and proximal breadth for Ovis aries C.18 Astragalus length and breadth for Ovis aries C.14 Metacarpal proximal breadth for Ovis aries C.15 Tibia distal breadth and depth for Ovis aries C.16 Metatarsal length and proximal breadth for Ovis aries C.17 Metatarsal length and proximal breadth for Ovis aries C.18 Astragalus length and breadth for Ovis aries C.19 LSI compar	260 261 262 262 263 266 266 266 267 267 268 268 268 268
 B.63 Breadth comparisons of astragalus for <i>Sus domesticus</i>. B.64 Depth comparisons of astragalus for <i>Sus domesticus</i>. B.65 Length comparisons of calcaneus for <i>Sus domesticus</i>. B.66 Length comparisons of first phalanx for <i>Sus domesticus</i>. B.67 Breadth comparisons of proximal first phalanx for <i>Sus domesticus</i>. C.1 Scapula glenoid fossa breadth and depth for <i>Bos taurus</i>. C.2 Radius proximal breadth and depth for <i>Bos taurus</i>. C.3 Metacarpal length and proximal breadth of <i>Bos taurus</i>. C.4 Metacarpal proximal breadth and depth of <i>Bos taurus</i>. C.5 Metacarpal distal breadth and depth of <i>Bos taurus</i>. C.6 Tibia distal breadth and depth of <i>Bos taurus</i>. C.7 Metatarsal length and proximal breadth of <i>Bos taurus</i>. C.8 Metatarsal proximal breadth and depth of <i>Bos taurus</i>. C.9 Metatarsal length and proximal breadth of <i>Bos taurus</i>. C.10 First phalanx length and proximal breadth of <i>Bos taurus</i>. C.11 Radius proximal breadth and depth for <i>Ovis aries</i>. C.12 Radius distal breadth and depth for <i>Ovis aries</i>. C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i>. C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i>. C.15 Tibia distal breadth and depth for <i>Ovis aries</i>. C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i>. C.17 Metatarsal length and proximal breadth for <i>Ovis aries</i>. C.18 Astragalus length and proximal breadth for <i>Ovis aries</i>. C.17 Metatarsal length and proximal breadth for <i>Ovis aries</i>. C.13 Libia distal breadth and depth for <i>Ovis aries</i>. C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i>. C.15 Tibia distal breadth and depth for <i>Ovis aries</i>. C.16 Metatarsal length and proximal breadth and depth for <i>Ovis aries</i>. C.17 Metatarsal proximal breadth and depth for <i>Ovis aries</i>. C.18 Astragalus length and breadt	261 262 262 263 266 266 266 267 267 268 268 268 268
B.64 Depth comparisons of astragalus for Sus domesticus	261 262 263 266 266 267 267 268 268 268 269
B.65 Length comparisons of calcaneus for Sus domesticus B.66 Length comparisons of first phalanx for Sus domesticus B.67 Breadth comparisons of proximal first phalanx for Sus domesticus B.67 Breadth comparisons of proximal first phalanx for Sus domesticus C.1 Scapula glenoid fossa breadth and depth for Bos taurus C.2 Radius proximal breadth and depth for Bos taurus C.3 Metacarpal length and proximal breadth of Bos taurus C.4 Metacarpal proximal breadth and depth of Bos taurus C.5 Metacarpal distal breadth and depth of Bos taurus C.6 Tibia distal breadth and depth of Bos taurus C.7 Metatarsal length and proximal breadth of Bos taurus C.8 Metatarsal proximal breadth and depth of Bos taurus C.9 Metatarsal length and proximal breadth of Bos taurus C.10 First phalanx length and proximal breadth of Bos taurus C.11 Radius proximal breadth and depth for Ovis aries C.12 Radius distal breadth and depth for Ovis aries C.13 Metacarpal length and proximal breadth for Ovis aries C.14 Metacarpal proximal breadth and depth for Ovis aries C.15 Tibia distal breadth and depth for Ovis aries C.16 Metatarsal length and proximal breadth for Ovis aries C.17 Metatarsal length and proximal breadth for Ovis aries C.16 Metatarsal length and proximal breadth for Ovis aries C	262 263 266 266 267 267 268 268 268 269
 B.66 Length comparisons of first phalanx for <i>Sus domesticus</i> B.67 Breadth comparisons of proximal first phalanx for <i>Sus domesticus</i> C.1 Scapula glenoid fossa breadth and depth for <i>Bos taurus</i> C.2 Radius proximal breadth and depth for <i>Bos taurus</i> C.3 Metacarpal length and proximal breadth of <i>Bos taurus</i> C.4 Metacarpal proximal breadth and depth of <i>Bos taurus</i> C.5 Metacarpal distal breadth and depth of <i>Bos taurus</i> C.6 Tibia distal breadth and depth of <i>Bos taurus</i> C.7 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.8 Metatarsal proximal breadth and depth of <i>Bos taurus</i> C.9 Metatarsal istal breadth and depth of <i>Bos taurus</i> C.10 First phalanx length and proximal breadth of <i>Bos taurus</i> C.11 Radius proximal breadth and depth for <i>Ovis aries</i> C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.18 Astragalus length and breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	262 263 266 266 267 267 268 268 268 269
 B.67 Breadth comparisons of proximal first phalanx for <i>Sus domesticus</i> C.1 Scapula glenoid fossa breadth and depth for <i>Bos taurus</i> C.2 Radius proximal breadth and depth for <i>Bos taurus</i> C.3 Metacarpal length and proximal breadth of <i>Bos taurus</i> C.4 Metacarpal proximal breadth and depth of <i>Bos taurus</i> C.5 Metacarpal distal breadth and depth of <i>Bos taurus</i> C.6 Tibia distal breadth and depth of <i>Bos taurus</i> C.7 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.8 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.9 Metatarsal istal breadth and depth of <i>Bos taurus</i> C.10 First phalanx length and proximal breadth of <i>Bos taurus</i> C.11 Radius proximal breadth and depth for <i>Ovis aries</i> C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.18 Astragalus length and breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	263 266 267 267 267 268 268 268
 C.1 Scapula glenoid fossa breadth and depth for <i>Bos taurus</i> C.2 Radius proximal breadth and depth for <i>Bos taurus</i> C.3 Metacarpal length and proximal breadth of <i>Bos taurus</i> C.4 Metacarpal proximal breadth and depth of <i>Bos taurus</i> C.5 Metacarpal distal breadth and depth of <i>Bos taurus</i> C.6 Tibia distal breadth and depth of <i>Bos taurus</i> C.7 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.8 Metatarsal proximal breadth and depth of <i>Bos taurus</i> C.9 Metatarsal distal breadth and depth of <i>Bos taurus</i> C.10 First phalanx length and proximal breadth of <i>Bos taurus</i> C.11 Radius proximal breadth and depth for <i>Ovis aries</i> C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.18 Astragalus length and proximal breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	266 267 267 268 268 268 269
 C.2 Radius proximal breadth and depth for <i>Bos taurus</i> C.3 Metacarpal length and proximal breadth of <i>Bos taurus</i> C.4 Metacarpal proximal breadth and depth of <i>Bos taurus</i> C.5 Metacarpal distal breadth and depth of <i>Bos taurus</i> C.6 Tibia distal breadth and depth of <i>Bos taurus</i> C.7 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.8 Metatarsal proximal breadth and depth of <i>Bos taurus</i> C.9 Metatarsal distal breadth and depth of <i>Bos taurus</i> C.10 First phalanx length and proximal breadth for <i>Ovis aries</i> C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.18 Astragalus length and proximal breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	266 267 267 268 268 268 269
 C.3 Metacarpal length and proximal breadth of <i>Bos taurus</i>	267 267 268 268 269
 C.4 Metacarpal proximal breadth and depth of <i>Bos taurus</i> C.5 Metacarpal distal breadth and depth of <i>Bos taurus</i> C.6 Tibia distal breadth and depth of <i>Bos taurus</i> C.7 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.8 Metatarsal proximal breadth and depth of <i>Bos taurus</i> C.9 Metatarsal distal breadth and depth of <i>Bos taurus</i> C.10 First phalanx length and proximal breadth of <i>Bos taurus</i> C.11 Radius proximal breadth and depth for <i>Ovis aries</i> C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.18 Astragalus length and breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	267 268 268 269
 C.5 Metacarpal distal breadth and depth of <i>Bos taurus</i> C.6 Tibia distal breadth and depth of <i>Bos taurus</i> C.7 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.8 Metatarsal proximal breadth and depth of <i>Bos taurus</i> C.9 Metatarsal distal breadth and depth of <i>Bos taurus</i> C.10 First phalanx length and proximal breadth of <i>Bos taurus</i> C.11 Radius proximal breadth and depth for <i>Ovis aries</i> C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal proximal breadth and depth for <i>Ovis aries</i> C.18 Astragalus length and breadth and depth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	268 268 269
 C.6 Tibia distal breadth and depth of <i>Bos taurus</i> C.7 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.8 Metatarsal proximal breadth and depth of <i>Bos taurus</i> C.9 Metatarsal distal breadth and depth of <i>Bos taurus</i> C.10 First phalanx length and proximal breadth of <i>Bos taurus</i> C.11 Radius proximal breadth and depth for <i>Ovis aries</i> C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal proximal breadth and depth for <i>Ovis aries</i> C.18 Astragalus length and breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	268 269
 C.7 Metatarsal length and proximal breadth of <i>Bos taurus</i> C.8 Metatarsal proximal breadth and depth of <i>Bos taurus</i> C.9 Metatarsal distal breadth and depth of <i>Bos taurus</i> C.10 First phalanx length and proximal breadth of <i>Bos taurus</i> C.11 Radius proximal breadth and depth for <i>Ovis aries</i> C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal proximal breadth and depth for <i>Ovis aries</i> C.18 Astragalus length and breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	269
 C.8 Metatarsal proximal breadth and depth of <i>Bos taurus</i> C.9 Metatarsal distal breadth and depth of <i>Bos taurus</i> C.10 First phalanx length and proximal breadth of <i>Bos taurus</i> C.11 Radius proximal breadth and depth for <i>Ovis aries</i> C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal proximal breadth and depth for <i>Ovis aries</i> C.18 Astragalus length and breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	
 C.9 Metatarsal distal breadth and depth of <i>Bos taurus</i> C.10 First phalanx length and proximal breadth of <i>Bos taurus</i> C.11 Radius proximal breadth and depth for <i>Ovis aries</i> C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal proximal breadth and depth for <i>Ovis aries</i> C.18 Astragalus length and breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	269
 C.10 First phalanx length and proximal breadth of <i>Bos taurus</i>	270
 C.11 Radius proximal breadth and depth for <i>Ovis aries</i> C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal proximal breadth and depth for <i>Ovis aries</i> C.18 Astragalus length and breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	270
 C.12 Radius distal breadth and depth for <i>Ovis aries</i> C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal proximal breadth and depth for <i>Ovis aries</i> C.18 Astragalus length and breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	272
 C.13 Metacarpal length and proximal breadth for <i>Ovis aries</i> C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal proximal breadth and depth for <i>Ovis aries</i> C.18 Astragalus length and breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	272
 C.14 Metacarpal proximal breadth and depth for <i>Ovis aries</i> C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal proximal breadth and depth for <i>Ovis aries</i> C.18 Astragalus length and breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	273
 C.15 Tibia distal breadth and depth for <i>Ovis aries</i> C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal proximal breadth and depth for <i>Ovis aries</i> C.18 Astragalus length and breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	273
 C.16 Metatarsal length and proximal breadth for <i>Ovis aries</i> C.17 Metatarsal proximal breadth and depth for <i>Ovis aries</i> C.18 Astragalus length and breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	274
 C.17 Metatarsal proximal breadth and depth for <i>Ovis aries</i> C.18 Astragalus length and breadth for <i>Ovis aries</i> C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy 	274
C.18 Astragalus length and breadth for <i>Ovis aries</i>	275
C.19 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece and indigenous southern Italy	275
and indigenous southern Italy	
	276
C.20 LSI comparison of proximal breadth and depth for <i>Ovis aries</i> from sites of Greece	
and southern Italy - colonies included.	277
C.21 Astragalus length and breadth of Ovis aries from sites of Greece and Dalmatia	278
C.22 First phalanx length and proximal breadth of <i>Ovis aries</i> from sites of Greece and	
Dalmatia	278
C.23 LSI comparison of length and proximal breadth of <i>Ovis aries</i> from sites of Greece	
and Dalmatia	279
C.24 LSI comparison of proximal breadth and depth of <i>Ovis aries</i> from sites of Greece	
and Dalmatia	280
C.25 Scapula breadth and depth of glenoid fossa for Capra hircus	280
C.26 Radius proximal breadth and depth for Capra hircus	

C.27	Metacarpal proximal breadth and depth for Capra hircus
C.28	Metacarpal distal breadth and depth for Capra hircus
C.29	Tibia distal breadth and depth for Capra hircus
C.30	Metatarsal distal breadth and depth for Capra hircus
C.31	Astragalus length and breadth for Capra hircus
C.32	First phalanx length and proximal breadth for Capra hircus
C.33	Scapula glenoid fossa breadth and depth for Sus domesticus
C.34	Radius proximal breadth and depth for Sus domesticus
C.35	Metacarpal three length and proximal breadth for Sus domesticus
C.36	Metacarpal four length and proximal breadth for Sus domesticus
C.37	Tibia distal breadth and depth for Sus domesticus
C.38	Metatarsal four length and proximal breadth for Sus domesticus
C.39	Astragalus length and depth for Sus domesticus
C.40	Astragalus length and breadth for Sus domesticus
C.41	First phalanx length and proximal breadth for Sus domesticus

List of Tables

2.1 2.2 2.3 2.4	Simplified Mycenaean and Dark Age ceramic chronology for mainland Greece.12Chronology of southern Italy and Sicily.14Bronze and Iron Age chronology of Dalmatia18Hallstatt chronology for Late Bronze and Early Iron Age Croatia18
6.1 6.2 6.3	Sites of Greece in the study90Sites of southern Italy and Sicily in the study94Sites of central Dalmatia in the study102
7.1 7.2	Summary of Mann-Whitney U tests performed on measures of astragalus length, breadth and depth of <i>Bos taurus</i> for Greek sites
7.3 7.4	breadth and depth of <i>Bos taurus</i> for indigenous sites of southern Italy 131 Summary of results of Mann-Whitney U tests performed on LSI data of <i>Bos taurus</i> 136 Summary of Mann-Whitney U tests performed on measures of astragalus length,
7.5	Results of Mann-Whitney U tests performed on LSI values of <i>Ovis aries</i> from Greek sites and pre-colonisation indigenous sites of southern Italy
8.1 8.2	Summary of results of Mann-Whitney U tests performed on LSI data of <i>Bos taurus</i> indices
8.2 8.3	<i>aries</i> from Greek sites and indigenous and colony sites of southern Italy
A 1	Taxonomic distributions of Kastanas and Artemision Olympia 220
A.2	Taxonomic distributions of Kabirenheiligtum bei Theben and Heraklein de Thasos. 221
A.3	Taxonomic distributions of Kassope and Poseidon a Tenos
A.4	Taxonomic distributions of Torre Mordillo, Termitito and Coppa Nevigata
A.5	Taxonomic distributions of Monte Irsi and Incoronata
A.6	Taxonomic distributions of Pomarico Vecchio and Roccagloriosa
A.7	Taxonomic distributions of Archaic period Kaulonia and Lentini
A.8	Taxonomic distributions of Classical period Kaulonia and the sanctuary at Pantanello.224
A.9	Taxonomic distributions of Locri Epiziphiri and Eraclea Lucana
A.10	Taxonomic distributions of Škrip and Late Bronze Age Gradina Rat
A.11	Taxonomic distributions of Iron Age Gradina Rat and Spila Nakovana

A.12 A.13	Taxonomic distributions of Pharos and Resnik.	226
	(Spila Nakovana, Gradina Rat, Pharos and Resnik).	228
C.1	Standard measures used to calculate LSI for Bos taurus measurements from sites	
	in the Study	265
C.2	Standard measures used for the calculation of LSI values for measurements of Ovis	
	aries	271
C.3	Standard measures used in the calculation of LSI for <i>Sus domesticus</i>	285
D.1	Results of Mann-Whitney U tests performed on breadths of distal tibia of Bos taurus	292
D.2	Results of Mann-Whitney U tests performed on depths of distal tibia of Bos taurus	293
D.3	Results of Mann-Whitney U tests performed on astragalus lengths of Bos taurus	294
D.4	Results of Mann-Whitney U tests performed on astragalus breadths of Bos taurus . 2	295
D.5	Results of Mann-Whitney U tests performed on astragalus depths of Bos taurus	296
D.6	Results of Mann-Whitney U tests performed on lengths of first phalanx of Bos taurus?	297
D.7	Results of Mann-Whitney U tests conducted on length LSIs of Bos taurus	298
D.8	Results of Mann-Whitney U tests conducted on proximal breadth LSIs of Bos taurus	299
D.9	Results of Mann-Whitney U tests conducted on proximal depth LSIs of Bos taurus	300
D.10	Results of Mann-Whitney U tests conducted on distal breadth LSIs of Bos taurus	301
D.11	Results of Mann-Whitney U tests conducted on distal depth LSIs of Bos taurus	302
D.12	Results of Mann-Whitney U tests conducted on height estimates of Ovis aries	304
D.13	Results of Mann-Whitney U tests performed on trochlear breadths of humerus of	
	Ovis aries	305
D.14	Results of Mann-Whitney U tests performed on proximal breadths of metacarpal	
	of Ovis aries	306
D.15	Results of Mann-Whitney U tests performed on proximal breadths of radius of Ovis	
	aries	307
D.16	Results of Mann-Whitney U tests performed on distal breadths of tibia of Ovis aries 3	308
D.17	Results of Mann-Whitney U tests performed on distal depths of tibia of Ovis aries	309
D.18	Results of Mann-Whitney U tests performed on proximal breadths of metatarsal of	
	Ovis aries	310
D.19	Results of Mann-Whitney U tests performed on astragalus lengths of Ovis aries	311
D.20	Results of Mann-Whitney U tests performed on astragalus breadths of Ovis aries	312
D.21	Results of Mann-Whitney U tests performed on astragalus depths of Ovis aries	313
D.22	Results of Mann-Whitney U tests performed on lengths of first phalanx of Ovis aries.	314
D.23	Results of Mann-Whitney U tests conducted on length LSIs of Ovis aries	315
D.24	Results of Mann-Whitney U tests conducted on proximal breadth LSIs of Ovis aries 3	316
D.25	Results of Mann-Whitney U tests conducted on proximal depth LSIs of Ovis aries	317
D.26	Results of Mann-Whitney U tests conducted on distal breadth LSIs of Ovis aries	318
D.27	Results of Mann-Whitney U tests conducted on distal depth LSIs of Ovis aries	319

Preface

This study began with an investigation of faunal data from four sites of the central Dalmatian coast of the eastern Adriatic (Pharos, Resnik, Gradina Rat and Spila Nakovana). This area contains evidence of Greek colonisation from at least the fourth century BC, with indications of a possible sixth century BC colony on the island of Korčula or at least of trade in Greek ceramics and metalwork from roughly this period onwards (Kirigin 1990: 295). Faunal material from four sites - two Greek colonies and two indigenous - was analysed by myself, but needed a wider context in which to understand the implications of observed variations in the biometry of the domestic animals.

The identification of variation in the morphology of domesticated animals between two indigenous and two colony sites in one area was not considered a rigorous enough test for the identification of domesticate varieties in antiquity. In order to supplement these four sites, data was collected from sites in Greece for the purposes of comparison with data from the analysed sites in Dalmatia. This second data set from Greece was compiled as a comparative of the livestock morphology from sites in the area of Greek colonisation in Dalmatia. However, in order to test both the identification of livestock varieties, and the evidence from these varieties for the process of colonisation (organisation and trade), it was considered necessary to add an additional data set. In addition to the study of Greek colonisation in Dalmatia it was felt that another case study of Greek colonisation should be examined in order to comprehensively examine both the identification of livestock varieties and also the movement and trade of livestock to and around colonies. For this, the Greek colonisation of Magna Graecia (modern day southern Italy and Sicily) was included as a case study alongside the study from Dalmatia. These two areas are close geographically, but their colonisation by Greeks took place in very different periods of Greek history. It was felt that comparing the better studied sites of Magna Graecia from the less well understood Archaic period of Greek colonisation with the less well understood Dalmatian colonies from the more historically understood Hellenistic period would provide the best coverage of both livestock identification and colonisation. Data from a third study area in Albania were sought, as this area was colonized concurrently with Magna Graecia and is also on the eastern Adriatic coast. Unfortunately, data were not available for this area. Albanian livestock and colonisation must therefore remain the focus of a later study.

Chapter 1

Introduction: Zooarchaeology and the Quest for Colonisation

The number and range of commensal relationships that humans form with different species make us unique as a species. Humans not only live closely with a number of different types of animals but also control and manage them, thereby making them in many cases into vastly different species in form and function than before their domestication by humans. How this process began and developed, and the significance of domesticated animals to both modern and ancient societies, demonstrate our unique human ability to mould the world around ourselves. It is through a deeper understanding of human relationships with domestic animals in the past that we may more fully understand ourselves as a modern global species. Without the ability to maintain, control and manage our food resources through domestication of plants and animals, humans would have been unable to develop into the modern 'superspecies' we now are. Therefore, it is important to understand the development of our relationships with domesticates; they tell us much about how we became who we are today.

The key point about domesticated animals, which is both the cause and focus of this study, is that they are kept by humans. This may seem a basic point about domesticates, as it forms part of their definition (Arbuckle 2006:19; Vigne *et al* 2006:5), but humans not only keep domesticated animals but also manage them. It is through their association with humans that domesticated animals change morphologically to become recognizably different from their wild counterparts (Zohary *et al* 1998:130). This morphological alteration (along with human choices about whom and when to cull from herds) is a primary characteristic in both the archaeological and modern recognition of domesticated animals (Albarella and Payne 2005:589). The changes in animals under the pro-

cess of domestication form one of the main zooarchaeological inquiries into the archaeology of the Neolithic. The keeping, selection and management of animals caused them to change in morphology and behaviour into domesticates (Arbuckle 2006:19; Redding 2006:42). These changes did not necessarily cease with the advent of domestication. Human management of animals continued from the Neolithic to the present day; so also did the conditions (from this management) which caused the changes into domesticates. My main interest, and the impetus for the research illustrated here, is what can be determined when we consider the point of view that domestication (with its human selections, management and morphological changes) not only did not cease with the Neolithic but continued to alter the morphology of domesticates animals throughout antiquity to the present day. This is not a novel notion, as investigations into changes in the size and shape of domesticated animals have been carried out frequently in archaeology (see for example Albarella and Payne 2005; Arbuckle and Makarewicz 2009; Crabtree 2007a; Duru and De Cupere 2003; MacKinnon 2010; Tchernov and Horowitz 1991; Thomas 2005).

These investigations, combined with the view of domesticates as altered by their humans, led to my interest in the study of domesticated animals. Seen through their osseous remains recovered from archaeological contexts it has been argued (and is argued in this study) that domesticates can be considered a category of the material culture to those groups which keep them. This idea of animals as material culture is often expressed as the domesticated animal - both in and of itself and in the size of herds or the production of secondary products¹ - being part of the 'material culture' of a human group. Animals are tangible, and their uses and importance to and by a culture can be studied in the same way as any other category of material culture such as ceramics or metalwork. If we take the view that domesticated animals are both material culture and are altered in their morphology by domestication, is it possible that the management of domesticates by groups of a culture or region would cause changes to the morphology of those domesticates which could be recognized by archaeological inquiry? To put the question more succinctly, is it possibly to recognize archaeologically cultural or regional varieties of domesticated animals?

If it is possible to distinguish cultural or regional varieties of domestic animals in the past (on the basis of the morphology of their osseous remains), then these varieties (if identified) could be

¹The primary product of a domesticated animal being those items only obtainable post mortem, such as meat and hides; secondary products is the term used to refer to those products which can be gained from an animal during its lifetime: milk, wool, traction, etc. (Vigne and Helmer 2007:11).

considered material culture as well. That is to say, identified varieties of domesticated animals would be material culture in the archaeological record not only on the basis of their interpreted socio-economic importance to a human group but by their shape and the movements and alterations of these varieties across time and space. This would mean that the archaeological remains of domesticated animal *varieties* (through size and shape patterning of their bones and teeth) could be considered material culture of a site, culture or region. They would be material culture on the basis of their morphology, as well as their interpreted importance to the humans of that site, culture or region.

This question formed the initial basis of this study. If it could be shown that it was possible to identify varieties of domesticates both within and between cultural groups, it could be argued that the archaeological remains of domesticated animals could be considered a category of material culture. The difficulty lay in determining a good case study by which to investigate this question. It was not enough to examine the remains of domesticated animals from a single culture or region and look for similarities between sites. In order to argue for the identification (and therefore existence) of ancient varieties of domesticated animals for a culture it was necessary to identify such varieties in more than one culture or region, and to be able to distinguish between the two. As a means by which to test the hypothesis of cultural varieties of domesticates, another area of interest was brought into this study. Aside from a personal interest in the human management and manipulation of domestic animals I have also long been interested in the movements and interactions of people in the process of colonisation. Bringing both of these interests into conjunction provided an ideal format to investigate both interests simultaneously.

Colonisation, or the movement of groups of people from a given cultural group outside of the main area of their culture to settle in the area of another cultural group, is a key area for the investigation of interactions between cultures (Owen 2005:5). It is through this contact and interaction that archaeologists and anthropologists interested in the techniques and processes of inter-cultural interaction study colonisation. There are many examples of colonisation throughout human prehistory and history, each of which provides us with information about how we as humans interact with ourselves (those in our cultural or social group) and others (of other groups). Attempts to integrate cross-cultural studies of colonisation have only come out with a greater number and complexity of questions. First and foremost, the varied nature of colonisations in archaeology (as well as history, but it is the archaeological study of colonisation which will be addressed here) has led to a lack of consensus as to what exactly can be considered a colony, what is colonisation and what - from a theoretical point of view - is the colonial environment. Before these terms can be addressed in a cross-cultural framework, it is necessary to clarify both the terminology and investigations for each area of colonisation in the archaeological record. It is necessary to clarify in each case *what* this colonisation is, and *how* we can study it. The much researched, stereotyped and abused process of colonisation must be clarified before any cohesive cross-cultural studies of colonisation and human interaction can be approached. One of the most historically studied and misinterpreted processes of colonisation is that of ancient Greece (*c*.eighth-fourth centuries BC). Despite extensive research into the process, scale, organization and impact of Greek colonisation, there is still no overall consensus as to exactly how to identify and interpret Greek colonises in the many areas of Greek colonisation, or even if this process can be termed colonisation (Stein 2005:4; van Dommelen 2005:11; Wilson 2006:29).

Many studies have investigated the settlement of Greeks outside of their 'native shores', but aside from using lists and foundation myths recovered from ancient texts archaeologists and historians are still undecided as to exactly how to define a Greek colony. Many sites in areas known from textual sources to have been settled by Greeks bear evidence of Greek material culture, writing and even architecture. Some of these sites are considered Greek colonies, while others are not. What then constitutes a Greek colony? If a Greek colony can be defined as those settlements founded by emigrants from Greece and comprised of persons of Greek origin and hellenic ethnic affiliation, how then do we differentiate these sites from those with an abundance of Greek ceramics, metalwork or architectural styles but with indigenous populations? More discussion of this debate is given in Chapter 4, but it is from these questions that the present study has been developed.

What is required for the identification of Greek colonies is archaeological material which is easily identifiable, culturally patterned and identified with the movement of individuals from Greece. In order to distinguish the movement of humans from that of goods, the material culture studied must be indicative of the colonising humans without being subject to independent long-distance trade. This material culture must be abundant at sites, related to the movement of humans and not easily actively shaped by individual whims. It is for this reason that the movement of Greek varieties of livestock form an ideal component of Greek material culture through which to examine both the process of colonisation, the identification of colonies, and colonial interactions in areas of Greek settlement. Domesticated sheep do not independently conduct far-flung resettlement, they are relocated by humans. If we consider then that the movement of groups of emigrants, even if organized on a small scale (i.e. self-organized and not state-organized) could be hypothesized to have involved the translocation of livestock with colonists, the movement of these livestock to colonies could not only identify colonies, but also support the idea of organized settlement. The relocation of a few breeding pairs or individual animals from Greece to colonies with settling families (and subsequent appropriation of the majority of breeding stock from local groups) would provide a far different interpretation of the process of Greek colonisation in the Archaic to Hellenistic periods than the wholesale appropriation of indigenous livestock or the predominant relocation of Greek livestock over indigenous varieties.

For this approach, several arguments must first be made. The primary supposition here is that domesticated animals were not directly traded between Greece and either southern Italy or the eastern Adriatic. No specific evidence could be found for the long-distance trade in domesticated animals between these areas either in the period of colonisation or in the centuries which preceded it. There is, as can be seen in the following chapter, copious evidence for trade and contacts between these areas since at least the Later Bronze Age. However, this trade evidence does not indicate intensive contacts and interactions between these areas. The assumption that the movement of livestock in this period would originate solely from the movement of humans and not from trade between the study areas is made *a priori* in this study in the absence of evidence to the contrary. The other argument put forth here is that the movement of domesticated animals from Greece to a colony implies some degree of organisation. This point requires clarification. It is assumed here that the movement of domesticates relates to the movement of family groups or organized groups of individuals (however small) relocating to a colony to live.

The presence of Greek livestock translocated to colonies in preference to the appropriation of indigenous forms would not only indicate an organized settlement of a colony as a 'Greek' colony in its affiliation (or demographic composition) but may also inform us as to the nature of relations between colonists and indigenes in the area of said colony, or provide evidence for some specific (perceived) virtue or preference for the translocated variety of livestock. In this way, the presence of domesticated animals of a Greek variety in a colony outside of Greece is taken as evidence for a process of organization above and beyond that of long-distance trade in more portable goods (ceramics, amber, etc.) or the establishment of a trading post. This is tied to the primary argument that the movement of livestock relates to the movement of humans. If it was in fact the case that animals were traded either from as early as the Later Bronze Age or during the period of colonisation, we would expect to see remains of mixed varieties either in pre-colonisation indigenous sites with other evidence of Greek trade goods and/or mixed varieties of livestock in both indigenous and colony sites in the areas of colonisation from an early juncture.

There were several advantages to combining a study of determining the identification of cultural varieties of domesticates with one investigating Greek colonisation. From published sources it was already noted that either Greek livestock were enlarged at a point in Greek antiquity or that certain larger faunal remains at non-Greek sites were indicative of Greek livestock (Bökönyi 2010:19-20; Friedl 1948:35; Kron 2008:175). This 'enlarged' Greek livestock was mentioned but no data could be found which coherently examined evidence for its existence. As there were already untested references to 'Greek' livestock, then a comparison of Greek and indigenous livestock should not only settle the hypothesis for identifiable livestock varieties but should in theory then be able to distinguish Greek and non-Greek groups of livestock in areas of colonisation. Essentially, this conjunction of interests led to a series of hypotheses: Is it possible to identify cultural/regional varieties of domestic animals? Is it possible to distinguish Greek and indigenous livestock in areas of Greek colonisation? Provided Greek livestock could be identified, were these animals relocated with Greek colonisation? If these animals were relocated, what evidence could be found for the movement or intermingling of groups of Greek and indigenous domesticates?

This study examines both human management of domestic animals and through them human movement and interaction with colonisation; both critical areas of archaeological research. In the following chapters the possibility of identifying culturally specific variations of domesticated animals will be tested in the identification of Greek, central Dalmatian and southern Italian varieties of livestock. The identification of livestock varieties attributed to or developed by specific cultures could allow for the tracing of cultural interaction between groups via the movement or interbreeding of livestock. This theory is tested using the study of Greek colonisation over two critical periods in Greek development: the Archaic/early Classical and Hellenistic. Through the identification of biometrically distinguishable Greek livestock it will be shown that the identification and investigation of regional or cultural varieties of domesticates inform us not only about interactions between humans and domesticates in the past, but also between groups of humans.

In this study of the identification of livestock varieties through an examination of Greek colonisation and interactions, it is first necessary to understand the regions of study in their archaeological and historical context. A brief overview of the historical and archaeological context of Greece, southern Italy and the eastern Adriatic is given in Chapter 2. In this chapter evidence for organization and the scale of trade, contacts and interaction between these regions is examined. In order to better understand the changes in Greek culture and ethnic identification between the periods examined, Chapter 3 explores what it meant to be Greek from the Archaic to the Hellenistic periods (*c*.seventh to third centuries BC). This chapter focuses on social organisation, arguments for and against state or polis development in the Archaic period as well as a discussion on current approaches to Greek ethnicity and self-identity from the Archaic to Hellenistic periods. To address the subject of Greek colonisation, this discussion of what it meant to be 'Greek' is followed by a discussion in Chapter 4 of approaches to understanding the concept of colonisation and what constitutes a colony. This chapter contains an overview of current theory relating to colonisation both in general terms and more specifically as relates to that of ancient Greece.

Chapter 5 explores the evidence for domesticated animals as material culture. This chapter describes the unique suitability of domestic livestock as a material culture for examining the movement and interactions of humans. The possible methods for the identification and study of such livestock varieties are also examined. The plan of our study and the sites to be considered are detailed in Chapter 6, as well as a summary of the various hypotheses and interpretations which we may expect of the data studied. Maps showing the location of sites studied, as well as summaries of the sites, their excavations and the analysis of their faunal material are given here. Chapter 7 follows the search for recognizably Greek domesticates. In this chapter data from sites in Greece are compared with data from indigenous sites of the study areas in an investigation of the first hypothesis: whether or not it is possible to identify cultural or regional varieties of domesticated animals. Following this investigation of cultural livestock varieties, Chapter 8 investigates livestock morphology from sites of Greece, compared with colony and indigenous sites of central Dalmatia and southern Italy. A discussion of the findings from this study as well as future directions for research.

Chapter 2

Historical Background

For the purposes of this study, it is necessary to discuss developments in the areas of interest from the Late Bronze Age onwards. While developments from the Middle Bronze Age and earlier periods doubtless played important roles in the archaeologies of Greece, southern Italy and the eastern Adriatic, space constraints have required an arbitrary starting point for the historical background. For our present purposes, an examination of Mycenaean trade in the eastern and central Mediterranean and a discussion of the 'fall' of the Mycenaeans (and the subsequent Dark Ages in Greece) need only be limited to what provides us with a further understanding of contacts and development in these areas. For this we will consider evidence for both trade and contacts between Greece and the Ionian/Adriatic regions to delineate the scale and nature of contacts between the study areas prior to Greek colonisation in the Archaic period. Evidence for Mycenaean trade with the different study areas will be detailed in the following discussions of the Late Bronze Age in each area. In order to assess both the possible identification of cultural/regional varieties of domesticated animals as well as the process of colonisation in both central Dalmatia and southern Italy, it is necessary to have a firm understanding of cultural developments and - most importantly - contacts within and between these areas.

Ideally, a firm understanding of contacts, trade and cultural developments for these areas would be made from the Neolithic period onwards both with regard to the better-studied areas of material culture¹ as well as the identification of livestock varieties and their movements. As this background would have required extensive work in these areas, the time constraints of this project required that evidence of trade, contacts and other interactions be limited to the Later Bronze Age and periods

¹These 'better studied' areas of material culture being ceramics, metalwork, jewellery and other craft industries, particularly those for which we have evidence for trade between the study regions.



Figure 2.1: Map of the study area and nearby countries, showing the principal geographic regions mentioned in the text. Modern country names are given in *italics*, with geographical areas given in non-italic script.



Figure 2.2: Map showing the principal geo-political/cultural regions of ancient Greece (adapted from Kagan 2003).

of colonisation.

2.1 The Late Bronze Age: Collapse and Dark Ages

The Mycenaean civilization arose in Greece during the Bronze Age. The centre, so to speak, of Mycenaean civilization was the Argolid region of Greece (see Figures 2.1, 2.3 and 3.1). Mycenaean cultural attributes 'radiated' outward into the 'Mycenaeanized' regions of the Peloponnese as well as Thessaly and Epirus (Lewartowski 1989:17). The main centres of the Argolid were Mycenae itself and Tiryns, which developed into a huge fortified settlement during this period (Lewartowski



Figure 2.3: Map of Greece and Albania showing sites mentioned in this chapter.

1989:30). The extent to which different areas of Greece can be considered Mycenaean raises questions about what makes a centre or group Mycenaean. As Dickinson (2006:115) so succinctly pointed out "there is not a single feature that could be considered typical of Mycenaean material culture that is equally prevalent in every part of the Mycenaean region, except the decorated pottery". It is therefore difficult to speak of the 'Mycenaean' civilization as a cultural group. The Mycenaeans are best known by their centres (such as Mycenae and Tiryns) and artefacts, not as a unified culture.

Mycenaean trade is evident throughout large areas of the eastern Mediterranean in the form of Mycenaean ceramic sherds (Ridgeway 2006:30). Most of what we know about the movement of Mycenaeans (or at least their trade) comes from the ceramic evidence. There is a disparity in our understanding of trade and interaction in the Mycenaean period, as only the movement of the artefacts and not of individual persons or groups of people is understood (Burns 2010:12). The importation of Mycenaean ceramics into the various areas of study is detailed below.

Period	Dates	Period	Dates
EHI	c. 3000-2700BC	LHIIIA1	c.1390BC
EHII	c. 2700-2200BC	LHIIIA2	c.1365BC
EHIII	c. 2200-2000	LHIIB	c.1335BC
MHI	c. 2000-1900BC	LHIIIC	c.1185BC
MHII	c. 1900-1800BC	SubMycenaean	c.1125-1050BC
MHIII	c. 1800-1700	ProtoGeometric	1050-900BC
LHI	c.1600BC	Early Geometric	900-850BC
LHIIA	c.1500BC	Middle Geometric	850-750BC
LHIIB	c.1440BC	Late Geometric	750-700BC

Table 2.1: Simplified Mycenaean and Dark Age ceramic chronology for mainland Greece. EH - Early Hellaldic, MH - Middle Hellaldic and LH - Late Hellaldic periods of Mycenaean Greece. Post 1150 BC dates refer to Dark Age chronology (adapted from Burns (2010:14), Leighton (1999:149) and Snodgrass (2000:134))

Without going into detail on the development and structure of Mycenaean civilization (so far as any single 'Mycenaean civilization' can be identified), which is largely beyond the scope of the present enquiry, the Mycenaean civilization famously 'fell' over the thirteenth to twelfth centuries BC. The 'fall' of Mycenae did not come about with the explosions, running in the streets and screaming children imagined from disaster films, rather it was a multi-stage process whose impact on the structure of life in post-Mycenaean and Dark Age Greece is still not fully understood (Burns 2010:15). Evidence of destruction of at least part of the town and palace (citadel) was seen at Mycenae from the LHIIIB1 (Table 2.1). A similar destruction layer is also seen at the site of Tiryns in this period. The damaged sections were rebuilt and the palace was even enlarged. Another destruction sequence is seen at Mycenae in LHIIIB2 in which all buildings excavated outside the citadel were destroyed. Building activity in LHIIIC shows a regression although habitation continued in the city. No more monumental buildings were erected and changes can be seen to the town layout. Building at Tiryns in this period was confined to the areas of the lower citadel only. Another destruction event at Mycenae at the end of LHIIIC put an end to its grandeur (Lewartowski 1989:29). Tiryns continued to be occupied to some extent following the 'collapse' at the end of LHIIIC, as seen by sub-Mycenaean pottery and proto-Geometric houses at the site (Lewartowski 1989:30).

While larger centres have received more careful examination than those in the hinterland, the 'collapse' of Mycenae seems to coincide with the abandonment of smaller secondary centres. Large

settlements continued to be occupied (Lewartowski 1989:42). The LHIIIC shows no evidence for the arrival of new peoples or evidence of deliberate destruction and devastation. There is no evidence for significant changes in landscape, climate or sea level which might otherwise account for the abandonment of sites. What we do see is a significant decrease in the number of archaeological sites which may indicate a decrease in the regional population or a change in its distribution (Lewartowski 1989:101). The following period, aptly named the 'Dark Age', is less visible archaeologically and therefore sites are more difficult to date artefactually. In terms of material culture no great sweeping changes are suddenly seen at sites. A series of gradual changes in material culture is seen across the area of Greece leading up to the Iron Age (Dickinson 2006:116). Trade relations in this 'dark' period are more difficult to define than even in the Mycenaean period. Southern Italy contains some evidence of ceramics from this period, and it is assumed that small-scale trade was continuing between settlements of the Aegean and the rest of the Mediterranean, but lack of archaeological data has hampered detailed investigations of Dark Age inter-regional trade.

It is in the realm of burial practices and religion that the most apparent changes are seen in post-Mycenaean Greece. The adoption of cremation begins, spreads and eventually wins out for much of the area (Dickinson 2006:119). The important sites of Greek religion in later periods appear where they had no Bronze Age predecessor (i.e. Delphi, Delos). While Mycenaean religious practices represented the gods with votive offerings and unburnt food offerings as much as they did with anything else, the overriding importance of burnt animal sacrifice so important in later Greek society was not yet set and is believed to have developed in this period (Dickenson 2006:121). While some post-Mycenaean cemeteries contain graves notable for exceptional grave goods, there is no indication of a stable, established elite (Dickenson 2006:120). These changes in religion, burial practice, material culture and social structure, coupled with several centuries of Dark Age culture and development, culminated in the better known later period of the Archaic on which we will focus.

2.1.1 **Pre-Colonisation Italy: the Later Bronze Age**

The Later Bronze Age in southern Italy and Sicily dates from *circa* the fifteenth to the ninth centuries BC, although chronologies vary (Forsythe 2005:26; Table 2.2). Evidence for the existence of trade and potential contacts between this region and the Mycenaean civilization is well attested.

Later Bronze Age	с.1400-с.900 ВС
Iron Age	<i>c</i> .900- <i>c</i> .700BC
Archaic	<i>c</i> .700- <i>c</i> .600BC
Classical	<i>c</i> .600- <i>c</i> .525BC
Early Hellenistic	<i>c</i> .525-300BC
Later Hellenistic/Republican	<i>c</i> .300-50BC

Table 2.2: Chronological periods of ceramic chronology for southern Italy and Sicily (adapted from Forsythe 2005:26).

Finds of Mycenaean pottery for the Adriatic and Ionian regions are shown in Figure 2.4. As is plainly visible, evidence for exchange of Mycenaean goods is more prevalent in the western Adriatic than the eastern. It is worth remembering that this may be simply a sample bias resulting from the vast difference in excavation and survey between the areas. Currently, however, Italy displays far more evidence for Mycenaean trade contacts.

Southern Italy displays general trends in this period, with only slight alterations by area. While all areas are assumed to have been self-sufficient in subsistence and in procurement of raw materials (aside from metals), trade for metals and other goods (prestige objects, weaponry and 'luxuries' such as glass or amber beads) would have allowed each area to manipulate any local specialities or trade goods (into which there has been little to no research save potentially for textiles (Gleba 2008) for participation in trade with the Mycenaean civilization (and likely other less easily recognized regional cultures) (Eder and Jung 2005:491). The specific nature of these specialities or trade goods is not speculated upon. The existence of Mycenaean imported goods is often taken to imply the existence of goods traded in exchange for these (Eder and Jung 2005:492; Leighton 1999:147). From extensive archaeological survey, we know that settlement of the Late Bronze Age Brindisi (Figure 2.1: Puglia) region was largely restricted to coastal areas with little evidence for inland habitation (Burgers 1998:124). In this period (fourteenth to twelfth centuries BC) enclosed settlements in defensible locations with easy access to maritime networks were prevalent. Current survey evidence indicates that the inland landscape was fairly empty in this period and the initial Iron Age (eleventh to ninth centuries BC) (Burgers 1998:173). It is not until the Early Iron Age that regional settlement patterns show evidence of shifts towards centralized political redistribution centres (Borgna and Cassola Gida 2005:500). The coastal/maritime focus of the Late Bronze Age hillforts in this region is linked to Mycenaean trade in the Late Bronze Age (LHIIIA to LHIIIC:



Figure 2.4: Map detailing the locations of finds of Late Mycenaean Greek (or possible imitation) pottery in the Adriatic and Ionian regions (adapted from Eder & Jung (2005: 489) and Teržan (2007:Plate 34a)).

Table 2.1).

Trading links between the Mycenaean world and Sicily gave Sicily a more prominent position in Mediterranean trade. This in turn coincided with the emergence of proto-urban socially stratified communities at the Milazzese sites of the Aeolian Islands, Ustica in northern Sicily and Thapsos near Syracuse (Leighton 1999:147; Figures 2.1, 2.5). Hierarchies in settlements and structures and the presence of storage pithoi and jars all point to complex and unequal social organisation (Leighton 1999:183). For late Mycenaean ceramics, the most plentiful finds have been from sites on the Ionian and Adriatic coasts of Italy and eastern Sicily, with the Tyrrhenian coast currently falling far behind in ceramic finds (Forsythe 2005:21). The Aeolian Islands just off the Strait of Messina have several sites with Mycenaean LHIIIA-IIIB (1400-1200BC) ceramics. It was originally believed that earlier sites on these islands were abandoned in the thirteenth century BC (with



Figure 2.5: Map showing sites in Italy mentioned in this chapter.

Mycenaean collapse) and remaining settlements converted to hillforts around Greek settlement in the Early Iron Age. This has recently been shown not to be the case (Leighton 2005:262). Later Mycenaean ceramics (fourteenth to thirteenth centuries BC) are also found at coastal sites in Sicily, particularly at Thapsos, which is believed to have been a trading centre (Guzzo 1990:132). Ceramics of this period, along with glass and faïence beads are also found at the site of Taranto in Apulia. These are rarely found in the central Mediterranean outside of copious finds at these two sites. Both places seem to have been important ports of call for late Mycenaean trade in this area (Eder and Jung 2005:485).

This trade is argued to have impacted not only upon the well-attested craft production but also domestic and funerary architecture (particularly at Thapsos), although this is difficult to support (Leighton 1999:153). Ceramics and metalwork of Mycenaean origin are well attested in the Aeolian Islands and eastern Sicily (although with increased excavation, finds from central and western areas of Sicily are increasing). Aeolian imports come entirely from domestic contexts, while those from Sicily appear to come mostly from funerary ones. Local pottery predominates in all sites investigated (Leighton 1999:171). In any accounting of imported Mycenaean pottery it is worth noting that, while clay analyses of Mycenaean ceramics are not yet common across sites in this area, the first such analyses so far have shown that many Mycenaean pots are in fact local imitations and so should not be classed as trade goods. Some sites of southern Italy have imitations of local manufacture so well represented that they may in fact outstrip the actual imported items (Jones 2001:334; Leighton 1999:176). Of the 350 painted LHIIIA to LHIIIC Mycenaean sherds found at Broglio di Trebisacce (on the plain of Sybaris), no more than ten could be considered with certainty to have been imported; the rest (c.97%) were made of local clay in the Mycenaean style - dubbed 'Italo-Mycenaean' (Ridgeway 2006:305).

Broglio di Trebisacce and the Sibaritide group of Later Bronze Age sites also bear evidence of locally produced Aegean style pithoi (storage jars). At Broglio they are known as 'dolii depurati' and share production techniques with the Aegean manufacturing style more so than with the Italian handmade ceramic tradition of this period. They are seen in limited distribution over the Ionic gulf, as well as on the Adriatic coast, during the Late Bronze Age; in the Ionic gulf however they are found more widely and also at inland sites (Borgna and Cassola Gida 2005:497). While not trade evidence, this shared technological production of oversize storage jars points to a form of contact more substantial than occasional down-the-line trade in ceramics between the Aegean and southern Italy. That said, to judge from artefactual and settlement evidence, interaction between the Aegean and Italy in this period would not have reached the scale of that seen in later centuries. From studies of imported Mycenaean ceramics and metalwork, interactions can be argued to have been loose and involving reciprocal relations (Ridgeway 2006:306). No rigid trade relations between Mycenaean palatial centres and these areas of southern Italy and Sicily have been argued. If the scale of local imitation seen for Mycenaean ceramics at Broglio di Trebisacce can be taken as any indication, trading links between these two areas were certainly present, but may well have been small scale or sporadic.

2.1.2 The Eastern Adriatic Before Greek Colonization

The investigation of contacts and interactions between the Aegean and the eastern Adriatic prior to Archaic period settlement lacks a coherent approach. The investigation of interactions between

Period	Cal. C14 Dates	Cultural Groups
Earlier Bronze Age	2400-1800 BC	Cetina
Middle Bronze Age	1800-1400 BC	
Later Bronze Age	1400-900 BC	proto-Liburnian
Earlier Iron Age	900-400 BC	Early Liburnian
Later Iron Age	400-150 BC	Late Liburnian
Roman	150 BC-AD 500	

Table 2.3: Approximate ceramic/artefactual chronology for the Bronze and Iron Ages in Dalmatia (adapted from Chapman *et al.* 1996:7).

BA Br D	1300-1250/1200 BC
Ha A1	1250/1200-1100 BC
Ha A2	1100-1050/1000 BC
Ha B1	1000-900 BC
Ha B2	900-800 BC
Ha B3	800-700 BC

Table 2.4: Hallstatt artefactual chronology dates for the Later Bronze and Early Iron Age of Croatia (adapted from Karavanić 2009:92).

the Aegean and the 'barbarian Balkans' has suffered in recent decades as diffusionist. As has been shown by Maran (2007), it is in the third millennium BC that we see a transformation in evidence of maritime contacts in the eastern Mediterranean, with structural similarity in super-rich grave assemblages and hoards (specifically of "prestige goods/non-utilitarian objects", mostly weaponry and fibulae) from the eastern Adriatic to the Near East. This is also cited as the period in which later cultures such as the Greeks and Phoenicians developed their maritime contacts and knowledge. This similarity in material culture is not believed to express direct contacts between this area of the Mediterranean, rather an "interlocking network" of contacts through both terrestrial and maritime routes (Maran 2007:11).

It is in the Early Middle Hellaldic (Table 2.1) that we see good evidence of cultural contact and similarity, with the spread of tumuli burials across the Balkans and Greece, as well as some finds of Mycenaean ceramics and bronze artefacts in Albania (Galaty 2007:136). In Dalmatia Mycenaean sherds are currently known only from the Late Bronze Age hillfort of Škrip (Figures 2.4 and 2.6). Two sherds from two vessels have been recovered from here, both dating to the Late Helladic IIIB/IIIC. The hillfort also boasts unusual construction of its fortifications. Unlike other contemporary hillforts in Dalmatia, Škrip has walls of large rectangular stone blocks (Barbarić



Figure 2.6: Map showing sites in central Dalmatia mentioned in this chapter.

2009:320; Kirigin 2006:19).²

In the Late Bronze Age and Early Iron Age we see the largest and most complex settlements in Albania located near the coast (Gajtan and Shkodra), to take advantage of or perhaps control local maritime trade. This period in Dalmatia is best known for the lack of information available, largely due to a lack of detailed recent excavation of settlements from this period (Barbarić 2009:311). Settlements identified are mostly hillforts with the occasional pile dwelling and enclosed farmstead. Chronologies for this area are given in Tables 2.3 and 2.4. Although these hillfort settlements were in use throughout the Bronze and Iron Ages, in Ha A1 there was a marked increase in hillfort construction (Barbarić 2009:318). The majority of current artefacts have poor to no context, but typological associations are to the Panonnian Urnfield culture to the north, particularly for dating to BA Br D and Ha A1 (Barbarić 2009:311). In Ha A2 there are indications of the development of

²It should be noted, however, that hillforts of Late Bronze and Iron Age central Dalmatia are still under-researched, and therefore the significance of wall construction at Škrip cannot be determined.

a local tradition of bronze manufacture (specifically in northern Dalmatia) with contacts directed towards northern Herzegovina, moving into central Dalmatia in Ha B1 (Barbarić 2009:316).



Figure 2.7: Distribution of amber beads of the 'Tiyrns type' in the Adriatic and Ionian regions during the Later Bronze Age, including Greece and southern Italy. Adapted from Teržan (2007:Plate 36a).

After the collapse of the Mycenaeans and their trade we see changes in the trade routes. By the eighth century BC developments in Italy and central Europe had made these regions more desirable trading partners. Northern Albania also began to take a more active role in trade, perhaps sending goods to Etruria. Amber appears in large quantity in this region (Figure 2.7). Along with weapons of the 'Italian' type, we see the development of a local metalworking tradition in the so-called Albano-Dalmatian axes of 'Shkodër' type (Galaty 2007:137; Figure 2.3).

With regards to overland contacts, there is some evidence for trade of Greek items into Macedonia (although items are rare, particularly for prestige goods). Recent studies of contacts in Late Bronze Age Macedonia seem to indicate that this region operated as a buffer zone between the ter-


Figure 2.8: Distribution of violin-bow fibulae in the Adriatic and Ionian regions (adapted from Barbarić (2009:321) and Bouzek (2007:Plate 94b)).

restrial Aegean and Balkan zones. Trade through this region seems to have ceased within the borders of modern-day Macedonia, however. Ceramic studies indicate that local Macedonian finewares were traded both into the central Balkans and into Epirus and Thessaly, but Balkan wares did not pass south of Macedonia and Aegean wares did not pass north (Horejs 2007:297).

2.1.3 Pre-Colonisation Italy - 1100-800 BC

Following the period of Mycenaean collapse, the Late Bronze Age settlements in Sicily show a mix of continuity at some sites and abandonment at others from the Aeolian Islands and eastern Sicily. Southeastern Sicily moves towards defensive hillfort settlements. These changes are posited to relate to movements of people from peninsular Italy (Leighton 2005:278). In some areas of Italy and Sicily iron working and the continued use of cremation have been held as evidence for continued Aegean contacts after the fall of the Mycenaeans. This case is difficult to argue, as there has been little exploration and even less publication of sites with this evidence (Guzzo 1990:135). The best evidence for continued contacts between the Aegean and southern Italy comes from finds of Proto-Geometric and Geometric sherds (Ridgeway 2006:301). While not found as frequently as previous Mycenaean goods, these suggest some continuing trade with the Aegean area. As with

Mycenaean ceramics, proto-Geometric and Geometric sherds in southern Italy seem once again to be, in the majority, locally manufactured copies of Aegean wares and not directly traded. Other evidence shows the continuation of small-scale trade between these two areas after the breakdown of the palatial system. Amber beads of the 'Tiryns' type reached Greece and the Aegean Islands via the Adriatic in the LHIIIC (Figure 2.7). Metal ornamentations (fibulae, knives, swords, etc.) from Greece and Italy in the twelfth and early eleventh centuries BC have strong stylistic links. Parallel developments in military technology in the twelfth century BC also show evidence of communication between these two areas (Eder and Jung 2005:489). For generalized metal artefact production, evidence for continuity is seen in forms, with evidence for imports and change in a wider range of metal forms, luxury items (fibulae, knives, utensils: Figure 2.8) and ingots (Leighton 1999:176).

The maritime-trade focus of sites in southern Italian regions such as Brindisi is reinforced by the evidence for a shift of the redistributive and trade network in the region with the collapse of the Mycenaean civilization. With Mycenaean collapse, Mycenaean products unsurprisingly dropped off in this area of southern Italy. Some indications for trade are seen in ceramics (see above) but the trade network of the preceding centuries essentially dried up in the sub-Mycenaean (Eder and Jung 2005:493). By the tenth century BC stylistic similarity suggests that internal trade continues, but evidence for external and long-distance trade is lacking (Burgers 1998:174). At this time Sicily also began to restructure its regional trade, with evidence of trade partnerships focused more on metal-producing regions of Italy and the western Mediterranean such as Sardinia and Tuscany, with a wider use of metal goods. Regional metalworking styles developed, along with stylistic similarities between Sicily and southern Italy (Leighton 1999:207).

2.2 New Neighbours: Greek Settlement

Prior to any discussion of Greek Iron Age contacts and settlement in Italy it is first necessary to discuss another group which is known to have been highly active in the Mediterranean at this time: the Phoenicians. The people we know today as the Phoenicians (for that was the name given to describe them by the Greeks) came from the Near Eastern shore of the Mediterranean along the Levantine coast. In the Bronze Age this area was the kingdom of Canaan, which by the Final Bronze Age(c.1200 BC) - following the loss of three-quarters of their territory to the Israelites, the

Phillistines and the Aramaeans - the kingdoms of Bronze Age Canaan suffered a crisis of sociopolitical decline ending in the Iron Age land of the Phoenicians (Aubet 2001:13). This is not to say that the Phoenicians suffered the same degree of collapse around 1200 BC as seen with the end of Mycenaean Greece. The resulting Iron Age Phoenicians instead appear to have been a collection of loose city-states with the principal cities located along the coast on promontories (Aubet 2001:17). The main decline into the Iron Age (aside from the reduced territory, which put pressure on the remaining resources of the dense populations of the city-states) is seen in the reduced power of the kings and the palace structure. It is believed that in the Bronze Age Phoenician trade was either directed or at least managed by the palaces. In the earliest Iron Age, this trade appears to have reduced to a minimum. The period of 1200-1050 BC appears to be a quiet one of political recovery and the growth of the coastal city states with a corresponding quiet period for long-distance trade (Aubet 2001:25).

This reduction in trading activity was by no means a long-term consequence, as the accomplished and wide-ranging Phoenician merchants of the remaining Early Iron Age (1150-900 BC) appear to have been more-or-less independent operators, acting in collaboration with rather than under the control of the palaces of the growing city-states (Aubet 2001:118; Sommer 2010:123). By the eleventh century BC we seen finds from Cyprus indicating Phoenician contacts with the island from that period onwards (including settlement from the late ninth century BC), presumably geared towards the exploitation of copper sources in the interior of the island (Aubet 2001:52). Also in the late ninth century there is evidence of Phoenician trading with the Greek islands of Crete and the Dodecanese (Aubet 2001:54). According to textual sources, the Phoenicians began to establish colonies throughout the Mediterranean around 1100BC, beginning with colonies around the north-west coast of Africa and the southern coasts of Spain (Aubet 2001:161). From archaeological traces we cannot speak of Phoenician colonisation (or the Phoenician diaspora) having occurred before the ninth century BC. It has been argued that the period between the eleventh and ninth centuries BC was a period of Phoenician trade or 'pre-colonisation' which has simply left no currently identified archaeological traces (Aubet 2001:201; Sommer 2009:97). This theory remains to be verified.

From the ninth century onwards we see a diasporic explosion of Phoenician archaeological traces along the coasts of the Mediterranean, including the founding of Carthage (from at least the

early to mid-eighth century BC) as well as several other sites along the east coast of Andalusia in Spain and along the coastline of Sicily (Dietler 2009:7). According to historical textual sources (Thucydides 6.2-6), Greeks arriving for colonization in Sicily in the eighth century BC found the coasts occupied by Phoenician merchants, who relocated to the western coast of Sicily, nearest to Carthage and their enterprises in the western Mediterranean (Aubet 2001:165). There are many reasons given for the Phoenician diaspora, mainly revolving around the need for raw materials or other supplies and provisioning for the populations of the coastal Levantine city states. It is also likely that this Phoenician trade diaspora was in part fuelled by a search for profits as much as land or agricultural supplies (Aubet 2001:73). Phoenician colonisation in the Mediterranean is currently, in general, seen as being a more multicultural and trade based diaspora in opposition to the moreor-less contemporaneous Greek colonisation which is seen as land- or settlement-based (Sommer 2009:95).

The Phoenicians, then, were a non-Greek maritime collection of city-states who were trading, colonizing and in general operating in the Mediterranean at roughly the same time as the Greeks, whom we will discuss below. This does not mean that we should conceive of the Late Geometric or Archaic period Mediterranean as a land of Greeks vs. Phoenicians, but rather that we should remember that trade evidence (both of Greek and non-Greek goods) in this period may relate to movements of Phoenician merchants as well as of Greek colonists (Aubet 2001:244). It is also possible, and probable, that there were Greek settlers living in Phoenician 'trade' colonies as well as Phoenician settler/merchants living in Greek 'settlement' colonies (Sommer 2009:98). Archaeological materials attributable to both groups have been found together at sites of this period, such as at Pithekoussai (see below) (Boardman 2006:198). There is additionally tentative evidence, from historical sources and thus far unsubstantiated by archaeological inquiry, of the presence at least sometime before the sixth century BC of Greek colonies on the shores of North Africa around Carthage (Boardman 2006:197).

Also beginning around the ninth century BC, just prior to Archaic period Greek settlement in the Adriatic/Ionian region, we see the movement and settlement of the Euboeans (Euboea: Figure 2.1). The Euboeans, like the Mycenaeans and other earlier groups, are thought of as traders. Modern scholarship sees these maritime tradesmen following previous Mycenaean trade routes; unlike earlier groups, their contacts were more direct and sustained (Stocker 2009:145). The Euboeans

left few archaeological traces of settlements in the Mediterranean. Most of what we know of the elusive Euboean traders is gleaned from surviving texts, but some pre-colonial pottery suggests the presence of Euboean posts at sites such as Pithekoussai (Coldstream 1994:49; Figure 2.5). Dates for the foundation of Pithekoussai are traditionally placed in the mid-eighth century, but recent ceramic evidence has suggested that the actual foundation may be closer to 800 BC or earlier, which would explain its extensive area by the mid-eighth century BC (Ridgeway 2004:29; Stocker 2009:220).

To judge from the recovered artefacts, the Euoboeans were not alone in the use of Pithekoussai: they were joined by other Greeks such as the Corinthians and non-Greek maritime traders such as the Phoenicians (Ridgeway 2004:23). Comparatively little is known about Euboean settlements with regards to function and local interactions. They are believed by current scholars to have been mixed communities of settlers from both local and immigrant backgrounds. Settlement is perhaps also a strong term, as these Euboean outposts are thought of more as trading centres, similar to later Greek emporia rather than planned settlement communities or apoikia (Stocker 2009:155). The actual presence (and presumably settlement) of at least some Euboeans/Hellenes at Pithekoussai is supposed based on the presence of locally-produced forms of Euboean and Corinthian ceramics and local ceramics made with Euboean firing processes (Ridgeway 2004:26). Corinthian exploration into the Ionian and Adriatic regions may also have begun as early as that of the Euboeans; Pithekoussai provides a good potential example. A Messapian site under the modern city of Otranto has yielded a sequence of Corinthian fine pottery dating back into the early eighth century BC (D'Andria 1990:282; Figure 2.5). Greek ceramics (mainly Corinthian) are found on both Adriatic coasts by this time, although settlements are not known for at least another fifty years (Coldstream 1994:48; Stocker 2009:201).

Following from the developments and interactions between the eastern Adriatic and Aegean worlds in the Late Bronze Age, we have the appearance around the seventh century BC of the Greek colonies of Epidamnus on the promontory of Dyrrachium and Apollonia on the Bay of Valona (Figure 2.3). In all fairness, any consideration of Greek settlement along the Albanian coast must start with another settlement in modern-day Greece. The settlement of Corcyra (734/733 BC according to Thucydides) shares the distinction with Syracuse as being the first 'colonies' of Corinth (Stocker 2009:235). While technically not part of the present-day Albanian coastline,

Corcyra is only out by a fine margin, and should be considered as an initial Greek settlement of the eastern Adriatic coast. Corcyra was in a unique strategic position for trade, as it (together with Syracuse and later Oricum) controlled the Strait of Otranto (D'Andria 1990:283). The earliest Greek finds to date from Corcyra are three Eretrian sherds from the ninth-early eighth century BC. The earliest Corinthian material is mid-eighth century BC, which supports the date given by Thucydides. Almost from its beginning, Corcyra began to flex its muscles in the Ionian and Adriatic Seas, becoming an important naval power. Over the seventh to sixth centuries BC, Corinthian imports began to dominate the assemblage along with Ionian and Attic goods (Stocker 2009:241). This settlement of Albania (and concurrently in Italy) brought peoples of the Adriatic region into more sustained contact with Greeks for the first time. In the sixth century BC we begin to see evidence of Corinthian pottery traded up the eastern coast of the Adriatic into Dalmatia (Wilkes 1969:1).

With regards to the foundations of Apollonia and Epidamnus, our understanding is more vague and owes much to recent research by Galaty (2007), Stocker (2009) and others. We have no ancient texts which directly discuss the foundation, composition or interactions of either settlement. Apollonia, as with other sites of Albania, was largely excavated prior to the Second World War, with the early levels neglected in favour of the Hellenistic and Roman monuments. It is nevertheless believed to have been the second settlement or *apoikia* founded in ancient Illyria, with a traditional foundation date of 588 BC. As is neatly demonstrated by Stocker (2009:256), this date rests on no solid historical or archaeological foundation: it appears to have resulted from a misinterpretation by eighteenth-early nineteenth century scholars of passages by Plutarch, Strabo and Pausanias. From ceramic evidence she suggests a date closer to the seventh century than the sixth. The earliest Greek pottery found in the hinterland of Apollonia dates to the mid-seventh century BC and is entirely Corinthian (Stocker 2009:205). This discrepancy in the foundation dating of the site remains to be firmly resolved. For our purposes, we can say that Apollonia was probably founded at some point after Corcyra, but likely before 588 BC. As for its official human founder (oikist), Apollonia was either founded by Phoebus Apollo, Abantes of Euboea or a Corinthian aristocrat named Gylax, as all three accounts exist in surviving texts (Stocker 2009:262). Oddly, the credible suggestion here (from Stephanus of Byzantium) is that the colony was originally of Corinthian allegiance (named Gylakeia) and then renamed itself Apollonia with the rise in power of Corcyra relative to Corinth (Stocker 2009:284).

In understanding the interactions between Apollonia and the indigenous communities in its hinterland we owe much to the work of the Mallakastra Regional Archaeological Project (MRAP) conducted in the hinterland of Greek Apollonia and the Illyrian hillfort of Margellic from 1998 to 2002 (Amore 2005:47). We see here indications of nucleated Greek settlement in the Archaic and Classical periods, with each group living around their respective major settlement. From textual sources we are told that Apollonia was a well-governed, self-governing *polis* (presumably from its inception) (Strabo: 7.5.8). Aristotle tells us (Aristotle: 4.3.8) that the Apollonian government was a narrow oligarchy, and that the polis consisted of citizens descended from original Greek colonists with power and offices filled by the nobility. We do know archaeologically that both Apollonia and Epidamnos minted large quantities of their own coins (Hammond 1968:8). In the Hellenistic period we see a change in Apollonian settlement pattern to a more dispersed farmstead approach throughout the area (Galaty 2007:135). Whether this expansion was the result of conquest and expansion of Apollonia, assimilation of local indigenous groups, or cooperation between colonists and indigenous groups is unclear. We are told (from surviving texts) that the polis extended its lands to the south in the mid-fifth century BC through conquest of Abantis and the city of Thronium (locations unknown) (Stocker 2009:293).

As for the colony of Epidamnos, we know even less than for Apollonia. Epidamnos was founded in 627 BC (derived from that for the foundation of Apollonia) (Stocker 2009:253). Given the uncertainty of traditional (textual) dating for Apollonia, the foundation of Epidamnos should likewise considered only approximate until archaeologically supported. According to later textual sources, we are told that the area of Epidamnos was held by the Liburnians (an Illyrian tribe) in the seventh century. We are not told what the relationship was between these locals and colonists of Epidamnos. As Apollonia was a riverine port (on the Aous/Vjosa river), the excellent harbour at Epidamnos made it the main port of the Ionian Gulf for maritime trade along the Adriatic coast (Hammond 1968:4). However, considering explanations of the social structure and ethnic identity of Apollonia given above in reference to that of Epidamnos, it seems to have been a more cosmopolitan society, potentially indicating a less rigid hierarchy of Greek-only citizenship than that seen at Apollonia (Aristotle:4.3.8; Strabo:7.5.8).

2.2.1 Initial Greeks in Italy

For the western coast of the Adriatic and Ionian Seas, the archaeological evidence is more robust owing to significantly more excavation and analysis as well as historical records. From the time of Greek colonisation onwards, a broad brush sees the area subjected to increasing urbanism and social stratification and the development of states as well as population growth (Nijboer 2004:137). Early research into Magna Graecia (as this region was later called by the Romans) revolved very much around a stereotypical view of hellenization (see Section 4.2). It is only in recent decades that individual assessments of indigenous sites are being conducted in order to better understand interactions in this area of colonisation. How well this increase in social complexity and urbanism relates to Greek colonisation in the area is not certain, and it should not be assumed that one directly caused the other. So as to avoid the broad-brush approach as much as possible, developments will be examined in each study region.

Beginning with the final millennium BC (the tenth century BC) we see Aegean trade with southern Italy and Sicily begin to pick up again. This period also sees the advent of the Iron Age in the area (Table 2.2). This chronological change is not coincidental, as iron had been known in this area before 900 BC. The chronological change (although the exact chronology for this area is still somewhat debated) is concurrent with the perceived renewal of contacts with the Aegean after the decline in trade of the twelfth and eleventh centuries BC (Hodos 2006:3) The end of the Early Iron Age in this region is less clearly defined, as it ends with the Archaic period and the arrival of Greek colonists (*c*.ninth to eighth centuries BC), and these two phases blend together at most sites (Hodos 2006:4). Imported goods of the tenth and ninth centuries BC are occasional and are interpreted as individual gift exchange or sporadic trade. By the end of the eighth century BC there is a clear increase in the volume and variety of Aegean goods imported into southern Italy and Sicily (Hodos 2006:5).

Greek settlement begins in this area roughly around the eighth century BC, although there are some suggestions for a slightly earlier date (see Pithekoussai, above). The intervening centuries between the fall of Mycenaean trade and the beginning of the Iron Age had seen an increase in regional styles in ceramics and metalwork throughout southern Italy and Sicily (Leighton 1999:190). Some stylistic developments, such as the matt-painted Salento Middle Geometric pottery of the ninth/early eighth centuries BC, have correlates on the eastern shores of the Adriatic - in this case the Devollian geometric traditions of the Korçe district of Albania (Burgers 1998: 180; Figures 2.5, 2.3). Aegean ceramics, notably Corinthian amphora sherds, are also found in the Salento area in this period, although at extremely low densities. Settlement survey of the Salento region also shows indications of developing settlement hierarchy in this period (Burgers 1998:170).

Iron Age settlement in Sicily, by contrast, is generally regarded as less hierarchical than in the preceding Late Bronze Age (Leighton 1999:189). Imported ceramics in the region (southern Italy and Sicily) are sporadic by context before the eighth century BC and do not suggest regular trade (Hodos 2006:4). In Sicily the earliest Iron Age Aegean imports are Euboean and date to the middle of the eighth century BC. These are soon replaced by Corinthian ceramics at the end of the eighth century BC. These early ceramic imports are generally related to wine and its consumption. These initially had a highly restricted circulation before becoming more widely used and imitated (Hodos 2006:9). Even when Greek imports became more common, ceramics still far exceed evidence of metalwork or other imported goods (Herring 1991:121). As there is as yet no strong evidence of viticulture in Italy before the arrival of the Greeks, it is assumed that this trade in wine and wine paraphernalia was of high 'value' and novelty, particularly in its early stages. It is suggested that wine drinking may have been a status activity in Early Iron Age indigenous Italian communities (Burgers 1998:185; Herring 1991:121). The shifting hierarchy in settlement in this period in southern Italy and Sicily may have created an ideal arena for wine as a luxury item in social competition, similar to that argued for the Rhône Basin of southern France by Dietler (1990:475; Hodos 2006:154).

Salento region ceramics of the later eighth/early seventh centuries BC correspond in decoration with those wares of contemporary western Greece (Burgers 1998:180). Over the Archaic period in southern Italy and Sicily there are several changes coincident with Greek settlement. In Sicily during the eighth and seventh centuries BC some communities moved inland, as evidenced by an increase in inland hilltop settlements in this area (Leighton 1999:192). The coastal sites were not necessarily abandoned with the arrival of Greek settlers (Leighton 1999:188). While it is common at coastal sites both in Sicily and southern Italy to see the abandonment of indigenous sites at or just prior to their 'reoccupation' by Greeks as colonies (Syracuse, Morgantina, Lentini, Incoronata), more recently researchers have investigated the mixed cultural nature of these settlements, showing the ethnic make-up of these 'Greek' colonies to be far more complex than previously assumed (Antonaccio 2007:210; Hodos 2006:100). Some locations, such as Syracuse, Lentini and Locri Epizephiri, seem to have replaced indigenous settlements with Greek ones (Hall 2004:39). Other settlements, such as Morgantina and Incoronata, have been argued by modern research to have remained as 'creolized' Greek and indigenous communities (Antonaccio 2007:214; Burgers 1998:194). Other sites, particularly from survey in southern Italy, show a continuation of indigenous occupation alongside Greek settlements throughout the Archaic and Classical periods (Burgers 1998:195; Carter 2004:389; Herring 1991:119).

2.2.2 The Classical (600-400 BC) and Hellenistic (400-229 BC) Periods

Greek settlements in southern Italy developed a fully urban form in the sixth century BC with native sites showing increasing centralization over the course of the fifth and fourth centuries BC. The area of Greek direct territorial control even in the later Classical and Hellenistic periods is not believed to have surpassed the chora (hinterland) of any settlement, which was around 15 km from the city (Herring 1991:119). With regards to ceramic finds, the pattern follows that seen elsewhere in the Mediterranean. Corinthian and other imported western Greek wares became more common over the seventh and sixth centuries BC. East Greek³ ceramics arrived in the seventh century and grew in popularity over the Classical period, becoming the most popular imported ceramic type by the fifth century BC.

In southern Italy and Sicily native settlements locally produced regional wheel-made forms of Greek imports from the sixth century BC onwards. Unlike the earlier local Mycenaean copies, these Italian-produced ceramics were not imitating imports but made in their own style with roots in earlier native matte-paint ceramic traditions; the forms included a preference for those associated with wine-drinking (Herring 1991:129). Metal objects of Greek manufacture were less common imports into native settlements (generally in the form of weaponry, jewellery and vessels), with coinage appearing as well in these later periods of settlement (Herring 1991:121). The precise nature of this trade has been widely discussed, especially what was being traded between these communities in exchange for items of Greek manufacture. As no objects of indigenous Italian or Albanian manufacture have been identified at colonies or sites in Greece, speculation has centred on the exchange of raw materials for 'luxury' products of Greek manufacture (Herring 1991:124). These take the

³Those poleis situated on the eastern coast of the Aegean, largely in what is now Turkey.

form of the assumption of timber, slaves, grain or animal products generally resorted to in speculation when no identifiable artefacts exist (see for example Kirigin 2006:42; Wells 1990:223).

With regards to self-perceptions of identity among colonists in southern Italy and Sicily, we know from Thucydides' (fifth century BC) account of the Peloponnesian War (see Chapter 3) that poleis of Magna Graecia fought both one another and alongside the factions of Athens and Sparta. Thucydides refers to Greek settlers of Sicily as Sicilians, which is a new term and suggests that these southern Italian and Sicilian Greeks did not identify or were not identified entirely as Greeks in the same way as the Greeks of the Aegean. It is also possible that this reference by Thucydides (3.90) simply indicated that the Greeks in question resided in Sicily, in much the same way as those Greeks residing in the Peloponnesus are referred to as Peloponnesian (3.89). A more detailed description of the major wars of the Classical period and their impact upon Greek perceptions of identity is given in Chapter 3.

After the settlement of the Albanian coastline, we lack evidence for any additional Greek settlement in the eastern Adriatic until the Hellenistic period. Classical sources refer to a Cnidian colony on the island of Corcyra Nigra (Black Corcyra) in the earlier sixth century BC. This has been hypothesized to lie on the Dalmatian island of Korčula, but no firm archaeological evidence has yet been found. Of the three likely sites on the island for such a settlement, one contains the modern town of Korčula, another (Lumbarda) was made an Issaian colony in the late Hellenistic period (see below); no evidence has come yet for any earlier settlement. The remaining site (Vela Luka) has yielded a single Corinthian pot but no firm settlement evidence (Kirigin 1990:293; Wilkes 1969:9). Additionally, coins are found in central Dalmatia from the site of 'Heraclea with a port' which remains unidentified (Kirigin 1990:294; Figure 2.9). From recovered coins the settlement is believed to have been located somewhere in central Dalmatia and to date to roughly the sixth century BC. However, aside from numismatic evidence there are as yet no definitive traces for the existence of such a settlement.

Those Greek settlements in Dalmatia for which we have archaeological evidence are restricted to the Hellenistic period. The settlements of Issa and Pharos were both founded in the early fourth century BC. According to textual sources (from Diodorus the Sicilian) Issa on the island of Vis was settled by immigrants from Syracuse under the auspices of the tyrant Dionysius I *c*.385/4 BC. At the same time, a group of colonists from the Aegean island of Paros was directed by the Oracle



Figure 2.9: Locations of finds of coins from 'Heraclea with a port' in central Dalmatia (adapted from Kirigin 1990:295).

at Delphi to found the colony of Pharos on the island of Hvar *c*.384 BC (Wilkes 1969:9). Issa is known to have founded other colonies along the Dalmatian coast and on some of its islands (Kirigin 2006:43). Both textual and archaeological evidence supports the presence of settlements or emporia at Tragurion and Epetion (modern day Trogir and Stobreč), but lack detailed archaeological inquiry. Other sites are known archaeologically but without textual evidence. Local excavations at the site of Resnik (Siculi) have uncovered a substantial third century BC settlement along the coast of Kaštel bay (Kamenjarin and Šuta 2011).

While we lack evidence for settlement in this area before the early fourth century BC, the spread of contacts along the Dalmatian coast can be seen beginning in the seventh century BC with the occasional finds of Greek manufactured objects (bronzes, ceramics, and occasional warrior equipment) (Babić 2007:73). These contacts continued in the spread of Greek 'cults' (or cult objects) through the area in the fifth and fourth centuries BC. The significance of these cult artefacts is open to interpretation, as it is also noted that the evidence of trade in this area of Dalmatia (in

the form of Greek goods) is less than in other areas of the Adriatic (Wilkes 1969:6). While the exact timing is unclear, current studies of hillforts in Dalmatia (as well as Istria) seem to indicate that the majority of development for these defensive settlement types in the Iron Age. However, the chronology of settlement is still uncertain (Mihovilić 2007:343). Up until this period in the fourth century BC we can see from textual sources that there was a common Greek misconception that the northern head of the Adriatic was very close to the Black Sea; only an isthmus away from the mouth of the Danube (Stocker 2009:295; Wilkes 1969:7). Whether this formed an impetus for settlement and prospective trade in the region, it does seem that the appearance of Greek settlements in Dalmatia coincided neatly with the realization that this 'isthmus' did not exist.

As with the other Greek settlements under discussion, textual sources tell us little as to interactions between Greek settlers and local groups. Tantalisingly, for Pharos we do know from surviving texts that indigenous groups from the island attacked the settlement the year after its foundation (Wilkes 1969:27). We are also told that by the middle of the third century BC all Greek settlements in central Dalmatia, with the exception of Issa, were subjects of the local Illyrian kingdom. The Illyric tribes of (at least) the Dalmatian coast are - unusually - given surprising detail in historical texts. Aside from this attack on Pharos, other historical texts provide references to local Illyric tribes.⁴ Surviving records indicate that Dionysus (of Syracuse) hired Illyrian mercenaries for a campaign against Epirus (Dell 1967:345). They were also used as mercenaries in the Peloponnesian War (Thucydides 1.25, 4.125). Philip II of Macedon (father of Alexander the Great) is recorded as having had a concern with inland attacks by Illyrian tribes; Alexander also fought against Illyric tribes (Dell 1967:345). In these cases the Illyrian tribes of the eastern Adriatic are referred to as a landward threat (e.g. not a maritime one) (Dell 1967:346). The maritime threat of piracy in the fourth century BC seems to have come from the Etruscans (Dell 1967:355). In later sources the Illyrian tribes⁵ became known in textual sources for their prowess as pirates. From 250 BC onwards the Illyric tribes formed at least two stable coalitions or regional importance the Dardanians of roughly modern-day Kosovo and the Ardiaioi of the Dalmatian Coast (Scholten 2003:134).

⁴The term Illyric, as used here, refers to a linguistic group of tribes along the eastern coast of the Adriatic and not necessarily to a specific cultural group. Many tribal names are given in textual sources for this area, but their precise locations and relations to one another are still under discussion.

⁵at least the Delmatae and possibly the Liburnians, with the Ardiaei moving to the coast from inland in the fourth century - although it is difficult to verify the correspondence between given tribal names and locations.

In the third century BC at least one faction of the Illyrian tribes was able to maintain enough force and centralized authority to become a dire threat to Greek and Roman interests in the area. Piracy and control of the Dalmatian coast under King Agron of the Ardiai and later by his wife Queen Teuta either directed or simply allowed for enough harassment of maritime trade in the Adriatic to incite Rome to send an envoy to deter them. This may also have had something to do with the fact that the armies of Queen Teuta were currently laying siege to Issa and Epidamnus after having reputedly taken Corcyra (Hammond 1968:4). Successful Illyrian conquest of the area would have effectively closed the mouth of the Adriatic to trade, or at least provided a greater hindrance than the already rampant piracy (Hammond 1968:6). It was the attempt in 230 BC of forces united under Teuta to subjugate the colony of Issa (Vis, Dalmatia: Figure 2.6) that led the remaining independent polis to call for help - in the form of a Roman invasion (Kirigin 2006:143; Wilkes 1969:12). According to Polybios they lodged a formal complaint with the Roman senate, who sent an envoy to Queen Teuta (Derow 2003:51). Queen Teuta returned the envoy as a corpse. This reply reputedly insulted the Romans to prompt an invasion across the Adriatic in the First Illyrian War. In 229 BC the defeated Queen Teuta was forced to pay heavy penalties and a distinct loss of territory. The Romans, for their noble efforts at keeping the regional peace, gained control of Dalmatia and Albania, and soon the remainder of the Balkans in this First Illyrian War and later also in war against Macedonia (Hammond 1967:7; Scholten 2003:137; Stocker 2009:70).

From this background into the archaeological and historical records of the locations under study, we can see that there is good evidence of trade between the areas of interest from at least the Late Bronze Age. Evidence for trade relations, particularly for ceramics, increases around the general time of the beginnings of Greek colonisation in these areas. This trade evidence, coupled with the note that much of the ceramics traded around the early period of colonisation (at least at some sites) related to wine consumption, begs the question of what was traded back in return for these more readily visible imports. The idea of trade in 'raw materials' such as animal products, is of particular interest for this study. Aside from evidence for trade, several Greek colonial sites in the study area are argued to have had pre-existing indigenous settlements. What would we expect to see in the archaeological assemblages of Greek colonies in southern Italy and Sicily if some of these settlements did indeed have direct indigenous precursors, and early trade goods were exchanged for 'raw materials'? Given the multicultural nature of at least ceramic evidence from the early site of

Pithekoussai, what sort of material culture signature would we expect to see in these Archaic Greek colonies? In the context of identifying varieties of livestock in southern Italy from indigenous sites, and in Greek colonies, this trade evidence is necessary for our approach.

The best (or at least most intensive) trade evidence between Greece and southern Italy dates to the Mycenaean period, which corresponds to the Late Bronze Age in southern Italy and Sicily. However, even in this period trade contacts do not exhibit evidence of intense or sustained contacts between these two regions (Greece and Italy). From this evidence the selection of pre-colonisation sites in southern Italy as one case study in the identification of domesticate varieties is ideal. In the case of livestock movement with colonisation, the case of the colonies mentioned above with indigenous occupation layers, as well as those sites described as 'creolized' (particularly Morgantina and Incoronata) are of particular interest. If Greek colonies were founded on indigenous sites with a substantial continuation of occupation by the indigenous population, we would expect to find a mixed signature in the livestock varieties (if identified). If this is not the case, then the occupation of these sites (at least from a livestock point of view) could be argued to have been wholly or at least in the majority Greek. This is not to say that indigenous persons would not have lived at the site, but that the dominant domesticate material culture would have been Greek. As far as the 'creolized' indigenous sites of southern Italy, the composition of livestock varieties in these sites (if discernable) would provide us with evidence of the intensity of trade contacts with Greek colonies, or possible appropriation of material culture.

In the colonisation of the eastern Adriatic, what was the impact of centuries of trade upon the colonisation in Dalmatia? In what way would we see changes in the identification of indigenous and colony livestock from that of Magna Graecia? Although this Greek colonisation did not occur until several centuries after that of Magna Graecia, it is still necessary to ground attempts at the identification of local domesticate varieties in the Later Bronze Age as much as possible. It is also necessary, if possible, to identify if any changes can be seen in domesticate varieties during the Iron Age in the areas of colonisation. How would we expect these later colonies, in a different (and possibly truculent), later setting to differ from those of Magna Graecia, if at all? In order to answer these questions, we first need to consider Greek colonisation. To do this, we need to consider what is meant by 'Greek' as well as 'colonisation'.

Chapter 3

History, Identity and Being Greek

[Homer] lived much later, born long after the Trojan War, and yet nowhere does he apply this name [Hellenes] to the whole of the Greek force, confining it to Achilles' contingent from Phthiotis, the original Hellenes: in his poem he calles Greeks Danaans, Argives, or Achaeans. Indeed there is no mention of 'barbarians' either, the reason being, it seems to me, that there had not yet evolved any equivalent generic term for the Greeks. [Thucydides 1.3] (words in brackets added by self)

In considering the experiences and interactions of the groups involved in Greek colonisation it is necessary to consider the two terms given. If we are to fully understand Greek colonisation then it is necessary to address what we mean when we discuss 'the Greeks' and what precisely we mean by 'colonisation'. As will be seen below, both of these terms are complicated and controversial. They are generally used more as terms of convenience in discussion than as words of settled meaning. Even in cases where we can argue a firm understanding of either, and more rarely both terms, this is restricted to a rather narrow chronological window. From a combination of archaeology and historical texts we can more or less understand the process in terms of timing, but how do we perceive this process as actually having been carried out? What did it mean to be Greek in the context of Greek colonisation? What are the theoretical approaches to understanding both the concept of Greeks and of colonisation in the periods under consideration in this study?

3.1 On Being 'Greek'

When we consider the process of 'Greek' colonisation it is important to understand what is meant by the term 'Greek'. This era of the 'Greek' world is distinguished from the preceding Dark Ages by its recorded history. For the first time we have texts, details, names, dates and motivations. This availability of data would in theory make the understanding of Archaic period Greece more straightforward. In reality, it is this level of detail which leads to greater difficulties. The majority of evidence we have for this period is either very fragmentary, of limited scope, comes from a later period in Greek history, or all of the above. Instead of a simple appraisal of the evidence, we have instead a hunt through modern research into what it meant to be 'Greek' in the Archaic period, and how that may have affected the colonisation process. As will be shown below, Greeks at the time of the Archaic colonisation of the Adriatic and Ionian regions can hardly be considered as 'Greek' in the unified political or even cultural sense. This settlement in foreign lands impacted the identity and development of the budding Greeks at least as much as it did their indigenous neighbours.

It is difficult to pin down specifically what it was that made Greeks 'Greek' in the Archaic period. The central themes of Greek culture and development in this period have been panhellenism and the polis - neither of which can really be shown to have existed prior to the developments of the period so much as formed as a result of them. The messy and complex formation of the identity of the peoples we know today as the Greeks came from the communities of the Mycenaean civilisation and the Greek Dark Ages. Over time they developed into the groups we know historically; defined by their shared religious cults and cultural contacts between poleis (Mitchell 2007:40). Greeks in the Archaic period had no overarching structure which united them, no universal institutions or ethnic or political affiliations (Vlassopoulos 2007:91). Greeks did not even speak the same language, merely a range of more-or-less mutually intelligible dialects; the language was not standardised until *circa* the late Classical and Hellenistic periods (Hall 2004:44). It is worth remembering in any discussion of 'Greek' culture or identity in this period the observations of the preceding chapter. The Mycenaean civilisation, as seen archaeologically, was not united so much by shared culture and traditions as by a collection of centres with palaces and written records with surrounding sites containing a mixed collection of Mycenaean artefacts, namely the ceramics (Dickenson 2006:115). In much the same way that limited textual sources and mixed archaeological remains make difficult the argument for a unified 'Mycenaean civilization'; the limited textual accounts and less abundant archaeology make difficult any unified characterisation of the Archaic period. In addition, we have to consider Greece from the point of view of before the better documented Classical period and after the poorly understood disparate regions of the Dark Ages.

The 'Greekness' of the 'Greeks' came from a belief in a shared cultural heritage which may have been developed prior to the Archaic settlement expansion or (as will be discussed below) may



Figure 3.1: Map showing the principal geo-political divisions of ancient Greece (adapted from Kagan 2003).

have derived from it (Stocker 2009:163). This great disparity in meanings of 'Greekness' becomes problematic when we look for indications of ethnic/cultural associations and changes with Archaic period colonisation. 'Greeks' in this period were well aware (we like to think) of how much their culture had been affected by adoption of traits from Asia (more specifically Persia) in the Orientalising period (*c*.tenth to eighth centuries BC). Greece at the time of initial colonisation into the Mediterranean was a collection of hellenic groups - hellenic here referring to a sense of shared culture (the development of this meaning, however, did not occur until later) (Walbank 2002:239). These groups, from our understanding, would perhaps have thought of themselves perhaps as 'hellenes', but more likely as belonging to one of a shifting series of ethnic and cultural ascriptions depending on the situation (Babić 2007:82; Hall 2004:50). Greeks of the Archaic period are associated with the idea of the polis - the city state. The polis as a concept or political state organization did not necessarily arise until closer to the Classical period (although this is still debated - see below). Greeks of this period would have identified themselves as 'Corinthian' or 'Spartan' rather than as Greek. Greece in the Archaic period (as well as in later periods) was a collection of shifting and fiercely independent poleis with their own governments, citizenship, laws, currencies, calendars and (until the Hellenistic period) alphabets (Walbank 2002:242).

In the absence of any political or social institution, specific language or national identity for the peoples of Greece in the Archaic period we use the ideas of panhellenism to define what it meant to be 'Greek'. Panhellenism was a sense of imagined community between the vastly different and often warring poleis of the Greek world. A shared mytho-history and shared religious cults - such as Delphi (although less important in the Archaic than Classical period) gave the nascent Greeks a common bond despite their differences (Walbank 2002:238). The story of their shared past gave a sense of shared present - and future (Mitchell 2007:65). In this way we can almost claim that the Greeks imagined themselves into existence. In reality, the underlying similarities of religion, community structure (in the form of the poleis) and several centuries of actual shared history (known or created) gave the Archaic Greeks a foundation on which to develop a common identity. It was in this period that the term *hellas* can be found relating to a shared cultural group (its meaning as a political unit came much later) (Hall 2004:37).

In terms of how we think about Greeks and their organisation in this period, the idea of the *polis* forms a standard for organisation and identity for colonising Greeks. The polis, or city-state, is seen

as the organisation with which Greeks would have identified foremost, and also the entity which would have organised the colonisation process. In thinking about Greek colonies it is important to understand how we should interpret the polis, its development and its effect on how we should see a colony (Stocker 2009:160). If we consider the polis to have been an established and codified socio-political structure for settlements and their citizens, then it follows that colonies would not only have been created by poleis but would have been set up from their inception as poleis - with all the structural fittings of poleis of mainland Greece.

In reality, the polis as we think of it today was for many regions of Greece not the main form of organisation and affiliation, and was not a defining Hellenic socio-political structure until the Classical period (Hall 2007:40). It would seem, then, that as with Greek panhellenic identity, the Greek polis (as an institution) did not carry the same weight in the Archaic period as it did later. This begs the question: what was the polis, and what was its importance in the Archaic period? In the Classical period the polis was a political entity (comprised of its citizens) as well as a physical settlement territory (either solely urban or urban and hinterland) (Hall 2007:41). It was the defining characteristic of male identity, citizenship in a polis was central, with the Other being not only the barbarian but also a citizen of another polis (Browning 2002:258). Did the polis in the Archaic period affect the process of colonisation (the organisation and identity of the new colonies) or was it rather the process of colonisation - and its interaction with foreign peoples, customs and lands - that changed the nature and codified the structure of the polis (Stocker 2009:163)? From Linear B tablets we know that Mycenaean states were divided into a series of embedded units for organisation and the collection of taxes. This organisation by physical space is seen as a precursor to the development of the polis as an organisation of physical space. While the polis did not develop as a conceptual institution during the Bronze Age, it seems that the forces behind its development were already in place (Hall 2007:59).

With regards to the polis and the process of colonisation, the generally accepted view is that a polis (or occasionally an alliance of two or more poleis) organised and sent forth a founder party of colonists led by an *oikist* (founder), which founded a new polis in a new land. This new polis was politically independent from the start, but was tied nominally to its mother city as allies and with religious and cultural observance (Wilson 2006:25). This alliance and cultural association between colony and mother city (metropolis) was declared specifically by Thucydides (1.25), in one of the few textual accounts of the specifics of this relationship (Stocker 2009:167). This statement, however was made several centuries after the onset of Greek colonisation (*circa* the late fifth or early fourth century BC). While the idea of new Greek colonies as independent entities remains unchallenged, the idea of the polis as an organised entity responsible for the organisation of colonisation has received considerable doubt.

There is little evidence in the Archaic (especially the early Archaic) period for the centralized political power associated with poleis. This argument in turn casts doubt on the organized nature of Archaic colonisation. If there was no central political authority - no polis - to arrange colonizer groups then it becomes difficult to argue the criteria for differentiating Archaic colonisation from settlement of the Dark Ages (Wilson 2006:33). The settlement of the Archaic period is then seen as of a varied nature, with some privately organized expeditions (or communal expulsions of unwanted individuals) and some smaller scale, more individual, relocations. Rather than state-sponsored colonies arising from detailed planning, these Archaic colonies would have been a mix of opportunistic and semi-organised affairs. This approach to understanding Archaic period colonisation provides good justification for the architecture of colonies (as discussed in Chapter 4), which was not so much the replication of a mother city as a mixed collection of traditions (Owen 2005:7). The only settled differentiation between these two periods of Greek settlement seems to be the location of Greek sites outside of what is traditionally seen today as 'Greece'.

Settlements within modern day Greece which originated in the Dark Ages are not seen as colonies, but those slightly further afield (such as Corcyra) are considered to be colonies when they were founded in the Archaic period. The colonisation of Magna Graecia and the Adriatic region was then not a great expansion of the Greek world via colonisation, it was instead a piecemeal movement of individual settlements and settlers. Essentially, so far as one can tell, the great distinction between Archaic settlement and that of the Dark Ages seems to be the greater historical detail and (perhaps more importantly) geographical scope rather than a shift in the structure of settlement.

If we consider the argument that the organized polis of the Classical and Hellenistic periods was not a deciding factor in Archaic period colonisation (as the polis as we consider it did not yet exist) it might be useful to discuss what we do know about Archaic period colonisation. To begin with, it was expansive. There is currently a consensus among recent scholars of Archaic colonisation that this process cannot be seen as a single process, but was rather a series of more-or-less independent foundations with general similarities. The colonisation of the Adriatic region was less a standard process than variations around a theme (Mitchell 2007:48). The settlements of the Archaic period which we call colonies were most notably located outside of the geographic area of modern Greece, in areas inhabited by presumably non-hellenic groups and in many cases followed from interactions of trade.

These similarities are magnified in the division between trading post settlements known as *emporia* and colonies known as *apoikiai* (homes away from home). An advantage of this division is that emporia are difficult to define, as their populations were transient and cosmopolitan and the settlement itself lacked structure (Stocker 2009:145). This has made emporia difficult to identify archaeologically, particularly in their foundation stages. Pithekoussai is believed to have been an emporion; its ceramic assemblage reinforces this idea - as does the indeterminate chronology of its earliest levels. Apoikiai are more easily defined. These are also difficult to identify in their foundation levels, and present varying geographic origins in their ceramic assemblages. There are, however, some common trends. The settlement endeavours appear to follow trade patterns of the earlier Late Bronze Age and emporia (to judge by Pithekoussai) appear to have appeared first. This pattern of settlement has been argued as evidence for the trade-basis in the foundation of at least some Archaic period settlements (Antonaccio 2007:210).

The pattern of a smaller exploratory party - whether of adventurous individuals or planned reconnaissance - beginning initial settlement and followed later by others is well accepted. Settlements were generally (at least at first) located in areas of good maritime access (harbours) and/or arable land, with a strong preference for defensive positions (Antonaccio 2007:207; Forsythe 2005:33). They were planned communities with civic centres and (sometimes indeterminate) hinterlands (Stocker 2009:172). It was not uncommon for settlements to be positioned in sight of one another (or at least nearby) as with Oricum, Apollonia and Epidamnos (Stocker 2009:202). This pattern also included the tendency of colonies to found their own colonies in the area to secure their territorial control (or to gain ready access to farmlands beyond the chora of the existing colony). A classic example of this tactic was the foundation by Syracuse of several daughter colonies to secure its territorial and trade control (Forsythe 2005:35). This expansion, coupled with the speed of colonial foundations across Sicily and southern Italy, forms some of the best evidence against the organised single-polis foundation story. Colonies were founded in this area at such a rate that

individual cities (such as Corinth) would have been unable to contribute a sufficient population in the time frame (Snodgrass 1994:2). With a large surplus of food and a farsighted, intensive breeding program to rapidly produce citizens, it is possible that an individual Greek city might have been able to field enough new people to occupy and expand a colony. It is, however, far more likely that the new colonies founded in Magna Graecia and the Adriatic region came from more than one city and probably as well more than one area of Greece. Archaic colonies (if not all Greek colonies) were therefore also of mixed Greek populations.

In a period when Greece possessed no single alphabet, dialect, or national identity, the common trait of our Archaic period Greek colonists was that they were strangers living in an even stranger land. The Greek conglomerate colonies combined various old practices and invented new ones; this can be seen in the (thus far investigated) architecture, ceramics and burial practices of Magna Graecia and the eastern Adriatic (Browning 2002:281; Stocker 2009:172). These early colonies, as well as possibly those founded in later periods might then be viewed more in the sense of centres of immigration rather than planned colonial ventures. An analogy comes to mind with immigration waves into the United States from various areas of Europe. The streets of Syracuse were not paved with gold, but neither were those of New York. A more realistic understanding of the colonisation process emerges when the idea of families or groups of neighbours from a given settlement area might consider relocation to a new land as a good way to improve their material circumstances (in escaping from debts, acquiring more or better land, etc.). Another less formal means of colonisation which springs to mind is the sentence of 'transportation'¹, which was common in European countries in the centuries of empire (see Chapter 4). This does not suggest that Magna Graecia was either the beckoning promised land or a convict colony, but rather that both such reasons for immigration might have easily formed a large part of the colonisation process as well as the movement of some more organised parties of individuals.

It was this process of colonisation in the Archaic period which helped the Greeks to identify themselves. The concept of a panhellenic identity grew and was solidified through interactions with peoples from the areas which were colonised. The development of the polis is also linked to this movement out and across the Mediterranean. The concept of the polis as a specific political

¹Transportation, or penal transportation, involved the forced removal of convicts either to a penal colony or as indentured servants to colonial areas.

entity developed - rather unsurprisingly - after a flurry of new communities was set up and forced to reflect intently on the various political structures of their mother cities in order to manage the organisation of the new settlement (Nippel 2002:282). Interactions with (more) foreign groups, along with cohabitation with semi-foreign peoples from other parts of Greece, would have provided these Archaic period Greek settlers with a continuous set of examples of similarities and differences between their fellow settlers from Hellas and the 'foreign' locals (Mitchell 2007:45). This is not to say that the process of colonisation taught Greeks to be xenophobic, rather that it provided Greeks with the all-important cultural mirror against which to view themselves. This understanding of the common traits which made them Greek was reinforced by and in turn added to the reinforcement of panhellenism and the panhellenic cults - seen to grow in popularity from the Archaic into the Classical periods (Hall 2004:39).

The outbreak of the Persian Wars circa 490 BC greatly developed the identification of Greeks *vis-a-vis* non-Greek cultures. In popular remembrance the Persian Wars were fought to protect Greece from the eastern barbarian invaders (see below). This idea in turn was transmitted backwards in the creation of shared Greek history to Hellas and the Trojan War as a Greek defeat of the Barbarian; this, however, came later (Mitchell 2007:170). The need to defend against Persian aggression led to an alliance of necessity among the poleis to a degree not formally seen before. In the Greek historical and literary tradition, the Persian Wars were the time of cohesion for the hellenes, an example of a unified Hellas banded together for the protection of all Greece from the decadent and amoral eastern barbarian. In reality, the alliances of the Persian Wars were formed of necessity, and the inter-polis warfare and fighting continued almost immediately once the Persian Wars was an imagined rather than actual one. However, the imagined sense of panhellenic unity and communal history and culture which grew out of the conflict with Persia are still of great importance when seen from the perspective of Greek identity.

The formation of an identity as 'Greek' can be argued to have developed slowly from as early as the Mycenaean or the Dark Ages. The shared cults and similar languages of the poleis created a sense of panhellenic identity, but it was the aftermath of these wars which caused the dichotomy in perception between Greek and Barbarian (Lissarrauge 2002:117; Mitchell 2007:41; Nippel 2002:283). It was as a result of the Persian Wars that the identification of Greek cultural

identity began to be seen as exclusive (us versus them) rather than inclusive from shared cultural traits and beliefs (Hall 1997:47; Saïd 2002:99).

This idea of the polis in the Archaic period has implications not only of how we should consider the process of colonisation, but also on the potential identification of Greek domesticate varieties. If we consider the argument that Archaic period Greece was comprised of a collection of nascent poleis (or other forms of city state) which functioned more-or-less independently, the interaction between these groups would have implications on the variety or varieties of livestock present in this period. If we are to consider these communities as 'hellenic' in the sense of a shared culture and interaction, as well as independent entities in a political or ethnic sense, then we can tentatively suggest that they may have contained livestock of the same larger variety. This rests on the premise that a series of interacting communities, although politically or ethnically independent from one another, would interact enough from community to community that livestock might be traded back and forth, communally herded or interbred. As will be seen below, these communities were often at war with one another. These wars, however, are believed to have been generally one- or two-battle affairs and not a continuous line of formal disputes. It can then be suggested that there is no clear evidence to contradict the assumption that livestock may have been interbred across the area of what we think of as 'Greece' in the Archaic.

If it was the case that the ethnically or politically dis-aggregated communities which became the state poleis of the Classical and Hellenistic periods were not interacting with one another in this earlier period, our attempts to identify Greek livestock varieties might see domesticates of different size and shape in different regions during the Archaic which homogenize during later periods. It is also possible that the ethnic and political independence of poleis in ancient Greece may be demonstrated in a total lack of uniformity in livestock morphology. If this is the case, then attempts to identify 'Greek' varieties of livestock would be unlikely to succeed. This matrix of independent city-states has implications not only for the attempted identification of Greek livestock, but also for the further investigation of livestock translocations with colonisation. As has been stated, the movement of livestock varieties (if identified) from Greece to colonies of southern Italy or Dalmatia is considered indicative of the movement of humans from Greece. If, however, the structure of inter-community (or inter-poleis) relations in Greece was such that no or multiple varieties of domesticates existed, is it reasonable to assume that colonies of a given area would contain similar livestock? If we take the assumption that colony foundations were directed by parent-poleis (metropoleis), and that community interaction in Archaic Greece was such that individual poleis (or groups thereof) contained their own livestock varieties, would we then expect to see the same domesticate varieties in colonies as in the parent-polis? If we take the view that colonies were settled piece-meal by emigrants from multiple communities of Greece, would we then expect to see colony livestock represented by a mixed jumble of multiple livestock varieties? Would we then expect to see a similar jumbled mixture of varieties at all colonies in an area, or would we expect to see distinct differences between the domesticates of colonies?

3.2 Two Greeces: Changes from the Archaic to Hellenistic Periods

After the 'explosion' of colonisation of the Archaic period, colonisation of the Adriatic during the Hellenistic period must be considered to have been conducted by a very different Greece. It has been argued above that 'Greeks' of the Archaic period did not identify themselves as 'Greek' in contrast to the 'barbarians' living near the new colonies. These colonists would have considered the members of another Greek polis almost as or as foreign as local groups around the colony. It is in the fifth century BC that the duality between 'Greeks' and 'barbarians' can be argued to have developed, in response to the Persian Wars of c.490-454 BC. The experience of fighting a foreign enemy (as opposed to the inter-poleis warfare which had occurred since before the existence of poleis) shows itself in the appearance of the use of 'hellenes' (Stocker 2009:145). The Persian Wars, however, were largely concluded after two major land battles and two major sea battles.

It was these 'wars' with Persia and the threat of non-hellenic invasion that united members of Greek poleis in a constructed panhellenic identity.² Beginning in the later sixth century, we see in Greece the first indications of panhellenic identity and organisation forming with the Peloponnesian League (Kagan 2003:4; Figure 3.3). This Spartan Alliance, as it is sometimes known, was not a strong united league of powers but more a loose confederation of states which came to the aid of one another when it was convenient or impossible to avoid. It was this strong alliance and the military standing of Sparta that caused it to take a primary stance in the organisation of the allied

²While a formulated panhellenic identity was already under construction prior to the Persian Wars, it was the impetus of invasion which caused the brief hiatus in inter-polis warfare in Greece in order to 'unite' against Persia. Inter-polis fighting resumed almost from the moment the wars ended.





hellenic poleis in the Persian Wars. Initially, Sparta refused to support the uprising of East Greek poleis (those in present-day Turkey) which were in turn supported by Athens and Eretria for one year (490 BC). In retaliation, Persian forces attacked mainland Greece, defeating the Eretrians, but were turned back by the Athenians at the battle of Marathon.

It can be argued that it was this attack upon the hellenic homeland by 'non-hellenes' which created a driving force to unify Greek poleis against a common enemy. For the next ten years internal politics between poleis aligned, and Athens and Sparta built up their forces (a navy, in the case of Athens). The major Persian conquest invasion began in 480 BC, and was soundly defeated at sea that same year at the battle of Salamis. In the following year they were soundly defeated on land at the battle of Plataea. The war continued against Persia after 479 BC with the united Greeks taking a more offensive approach against the Persians in Cyprus and Byzantium (Thucydides 1.94).

In the winter of 478/7 BC the anti-Persian loose alliance became formalized when those poleis not already allied to Sparta (in the Peloponnesian League) swore an eternal alliance to Athens in both defence and offence for the purposes of protecting Greece from Persian invasion (Kagan 2003:8). At its formation in 478/7 BC the Delian League (as it came to be known) was simply a network of inter-poleis alliances. Since Athens had by far the largest navy, participating poleis in the League had the option of either contributing ships and crews or simply providing coinage equivalent to the cost of maintaining ships which Athens would then provide. This Delian League can the be considered as a much more organized and unified panhellenic league than that of the Spartan Alliance. Not only did it unite an immense portion of Greece (Figure 3.3), the Delian League became in effect the Athenian Empire.³

It was not long after the main success of the Persian Wars that frictions arose between the growing and powerful Athenian Empire and the slightly older might of the Spartan Alliance. Far from a series of poleis with a loose and shifting network of alliances, the Persian Wars had created two major political alliance groups in Greece. Hostilities between Sparta and the growing power of Athens reached a head in 446/5 BC when Sparta marched on Athens. This First Peloponnesian War was over before it began, however, when the Spartans were convinced to sign a Thirty Years Peace. This peace in reality lasted only about fourteen years (Kagan 2003:18).

³By both controlling the largest navy and in effect collecting taxes from the majority of member poleis Athens was able to greatly increase its wealth and power during its brief 'empire' of 478-431 BC.



League poleis and allies are shown in blue. The Delian League poleis and their allies are shown in red. Other states in the area are identified in the grey surrounding geography. Macedonia, as an ally of both Sparta and then Athens, is left in grey. Adapted from Kagan Figure 3.3: Map showing the poleis of the Delian League (red) and the Peloponnesian League (blue) and their allies. The Peloponnesean 2003. While none of the events of 490-446 BC necessarily demonstrates a unified Greece identifying itself in contrast to the ideal of the 'barbarian', the web of alliances which built up over what is conventionally termed the Classical period are important in understanding the changes in Greece from the proto-polis organization of the Archaic period. What is important to note is that by this period hellenic poleis were not considering themselves in isolation - individuals were not only Athenians, Lesbians or Samians but were also hellenes and identified themselves not only with their city but with its place in a great power faction. Some poleis resisted their place within one or the other power faction (particularly in the case of the Delian League) but few managed to regain autonomy after joining an alliance. The hellenic world became so interconnected over the course of the sixth and fifth centuries BC that a small incident far to the north and practically off the map began a domino effect which ended in twenty-seven years of war, devastation, and the eventual control of a weakened Greece by Macedonia. A small incident, brought into this web of alliances, created in effect a world war.

In 436 BC the colony of Epidamnus in modern-day Albania erupted in civil war. The democratic faction took control of the city and forced the aristocratic group out where they joined forces with the barbarian Illyrian tribe of the Taulantians (Thucydides 1.24). Despite its early foundation and comparable proximity to Greece, Epidamnus was enough of an isolated backwater in the fifth century BC that its location and surroundings are given in detail by Thucydides. From this we can presume that Greeks of the fifth century BC would not have necessarily known its location and context. The civil war in Epidamnus caused the displaced aristocratic faction and its Illyrian allies to lay siege to Epidamnus. Besieged democrats within the city then appealed to its mother city - Corcyra - for assistance. When Corcyra refused they in turn went to Corinth (Corcyra's mother city, with whom it had a long-standing animosity). Corinth agreed to help the besieged Epidamnus⁴. This Corinthian assistance sparked a war between Corinth and Corcyra.

Corcyra turned to Athens in 433 BC for an alliance against Corinthian aggression. Despite the fact that Corinth was part of the Spartan Alliance, the Athenian assembly did not wish to see the sizeable Corcyrean fleet fall into Corinthian (and thereby Peloponnesian) hands. In an attempt to stave off war with Sparta, Athens made a defensive-only alliance with Corcyra and

⁴For an interesting parallel, it should be noted that a Greek colony under seige at least in part by an Illyrian tribe was in 436 BC the cause of a rescue fleet and a great war. In 229 BC a Greek colony under seige by an Illyrian tribe was the cause of a rescue fleet and anothert war, as well as the Roman conquest of Greece.

repeatedly asked Corinth not to invade Corcyra and thus draw Athens into the war. Corinth in its turn attacked Corcyra and forced the Athenian ships to intervene. Corinth then drew Sparta and the Peloponnesian League into declaring war on Athens in 432 BC. From this followed nearly three decades of warfare - an experience far in excess of the long-standing hellenic tradition of one-battle or two-battle wars. For a decade Athens in effect fought Sparta, with many cases of battles being decided with the losing side or city having all its men killed and the women and children sold into slavery (Thucydides 2.67; 3.36; 5.116; etc.).

Battles during the Peloponnesian War were not fought only in Greece, but also on the Hellespont, the Chalkidic Peninsula and in Sicily. Syracuse and several other cities allied to or supported by the Peloponnesian League (mostly located in southern and western Sicily) made war against cities of Athenian alliance in northern and eastern Sicily and southern Italy. The barbarian Sicels of Sicily fought for both sides, although mostly for the Athenians. In battles in Greece both the Spartan and Athenian alliances made use of the 'barbarians' (as all non-hellenic groups are repeatedly called by Thucydides). Sparta allied itself to Macedonia until angering the Macedonians at the battle of Mende in 423 BC (Thucydides 4.128), after which they switched their alliance to the Athenians. The Athenians used Thracian and Illyrian mercenaries and the Spartans and Athenians both sent diplomats to Persia in attempts to secure its financial and military assistance in overthrowing their enemies (Thucydides 2.67; 4.125). It was the Spartans in the end who ceded the East Greek cities to the Persians in exchange for financial support to beat the Athenians (Thucydides 8.87). From the account of Thucydides we can see that these non-hellenic groups were considered 'barbarians', but were also at the same time given the respect of being allies.

Two interesting notes by Thucydides demonstrate not only the hellenic view of 'the barbarian' but also a lack of panhellenic identity in stereotypes of other Greek poleis. When Athens in 413 BC disbanded a troup of Thracian mercenaries, they attacked the Boetian town of Mycalessus on their return trip - killing everyone (man, woman and child). Thucydides explains such behaviour as "these Thracians, when they have nothing to fear, are as bloodthirsty as any other barbarian race, even the worst, and here in Mycalessus they brought total panic and destruction in every form." (Thucydides 7.29). This bloodthirsty nature is of course less shocking when compared with the Greek habit of killing only the men and selling the women and children into slavery (Thucydides 2.67; 3.36; 5.116). It is also somewhat less shocking when one considers that, after the final Athe-

nian defeat at Syracuse in 413 BC the Syracuseans had the allied Athenian army of around seven thousand men imprisoned in an exposed quarry where they were given little food and water for seventy days before the survivors (what few remained) were sold as slaves (Thucydides 7.87). In contrast to evidence for the growth of panhellenic sentiment there is still equally substantial evidence for identity being associated with the polis: the Athenian general Demosthenes was persuaded by the Messenians to attack the Aetolians (Figure 3.1). They were a large and warlike nation but they lived in widely separated unfortified villages and used only light arms. "They advised an attack on the Apodotians, the Ophioneans, and finally on the Eurytanians, who form the largest division of the Aetolians, speak the most incomprehensible dialect and are said to eat raw flesh" (Thucydides 3.94).

In the landscape of the post-Persian Wars Greek world, the Greeks sought to identify and define themselves. This new definition was not only created in opposition to the non-Greek or anti-Greek barbarian (specifically from Asia), but was created from a sense of shared community and history within the accepted 'Greek' world. This sense of identity may in many cases have been fabricated for its cohesive purposes (as with the reflection of anti-barbarian sentiments of the Classical period back onto stories of the Trojan war), but this creation of a sense of shared identity and history in the face of the 'barbarian' outsider undoubtedly had implications not only on how the Greeks viewed themselves but also on how they viewed non-Greek peoples on all sides of the Balkan peninsula. Despite innumerable differences, what made the Greeks 'Greek' was a sense of imagined community - panhellenism. Over the post-Persian Wars Classical period the idea of panhellenism as differentiating Greeks from barbarians grew with the Greek recognition of 'us and them' (Mitchell 2007:29).

Hellenic sanctuaries such as Delphi had in the Archaic period already been growing in importance as communal hellenic centres of religion and culture. In the Classical period its importance grew again with the development of its exclusive panhellenic identity - to have placed a monument at Delphi is still an indication for classical archaeologists of the 'Greekness' of a polis. The development of a shared heritage - mytho-historical and cultural - is seen through the literary/oral tradition, as well as panhellenic festivals and cults/sanctuaries of the period, such as the greatly increased importance of Delphi (Mitchell 2007:30). The symbolic community imagined by panhellenism in many ways became more real following the Persian Wars, with greater cooperation and control between poleis in diplomatic negotiations, and stricter rules of warfare for disputes between poleis (as opposed to with barbarians) including treatment of prisoners and conquered groups (Browning 2002:281; Mitchell 2007:89). These rules of warfare were not always adhered to; their existence, however (like the motivations behind the Persian and Peloponnesian Wars), does illustrate an increasing sense of 'Greekness' or 'hellenic' identity over the Classical period.

The sense of what it meant to be Greek is then an interesting notion when considering Greek interactions with foreign groups in the Archaic period as well as in the later Classical and Hellensitic periods. We have a dichotomy between movement outside of Greece by peoples only linked in the sense of being slightly more alike than their new foreign neighbours (in the Archaic period) to the movement and experiences of peoples with a shared mythology clustered together and interacting with the 'barbarians' (in the later Classical and Hellenistic periods). From the events documented by Thucydides and others regarding the Persian and Peloponnesian Wars it can be argued that Greece was moving in the fifth century BC towards more unified regional groupings of alliances. However, from several notes such as the above from texts of the period it can also be argued that hellenic identity had not changed greatly from that of the Archaic period. Thucydides still identified groups of hellenes by their poleis and not by their league alliances. There are still stereotypes of fellow hellenes (and not only barbarians) being backward and unintelligible. What has changed is the network of alliances between poleis. Even these do not seem to have greatly altered Greece, as it has been argued that the actions of Corinth in bringing about war between Athens and Sparta implied a lack of understanding of the full implications of alliance networks and how these would alter the process of war (essentially, Corinth did not realize that war with Athens and Corinth could never be 'over by Christmas') (Kagan 2003:32). The end result of these alliance factions was revolt and civil war in many poleis of the Delian League, including Athens and Corcyra. After a blockade of Athens and the loss of its food imports, Sparta was finally able to emerge victorious in 404 BC (Kagan 2003:476).

It is in this post-Peloponnesian War period, within a generation of the end of fighting and all its associated atrocities, that Greeks from Syracuse and the Aegean island of Paros historically are known to have colonised Dalmatia. These Dalmatian colonies (considered in this study) are therefore the products of a different chapter of Greek history than those of southern Italy and Sicily. In what way did the process and experience of colonisation differ in Dalmatia from that of southern Italy? Why after all the recent history did they choose to settle in Dalmatia? Was it because of all the recent history that they chose to colonise such an out-of-the-way location by fourth century BC standards? How had the several centuries of history and conflict and new ideas about citizens, Greeks and Barbarians changed the landscape of colonisation in this time and place as opposed to the Archaic period settlement of southern Italy and Sicily?

If we consider Archaic period colonisation to have occurred in a time before the polis, when Greece was neither unified nor organized, then it would follow that the character of Archaic colonisation would similarly have been not unified and not centrally organized. Is this lack of organization critical to our understanding of the development and function of Greek colonies? If we consider Archaic colonists as a group of people bounded together as strangers in an even stranger land, how would this have affected the process by which they settled and developed their colonies, and their interactions with those groups in the new land even more foreign than they were to one another? Based on the theory that Greek colonisation of the Archaic would have been piecemeal movement of families or small groups rather than state-organized large expeditions, what differences would we expect to see between the two (state vs. non-state organized)? To put the question more bluntly, do these arguments for the state of state organization matter when it comes to examining Greek colonisation? It is for this reason that it is important to consider the changes in the political and social structure of Greece between the Archaic/early Classical and later Classical/Hellenistic phases of colonisation in the study areas. It is also important to consider what different lines of data have to say with regards to similarities or differences between both the areas and periods of colonisation. As this study does not allow enough space to argue coherently for all categories of material culture, we shall ask instead what the data from domesticated animals have to tell about the differences between Archaic and Hellenistic period colonisation in Magna Graecia and the eastern Adriatic. Provided that we can identify culturally specific varieties of livestock in Greece and the areas of colonisation, is state organisation required to see organised colonisation?

Chapter 4

Colonisation: Approach and Process

Nevertheless anyone accepting the broad facts of my account on the arguments I have adduced will not go wrong. He will put less faith in the glorified tales of the poets and the compilations of the prose chroniclers, whose stories are written more to please the ear than to serve the truth, are incapable of proof, and for the most part, given the lapse of time, have passed into the unreliable realms of romance. He will conclude that my research, using the clearest evidence available, provides a sufficiently accurate account considering the antiquity of the events. [Thucydides 1.21]

4.1 What is a Colony?

Given the interest in the investigation of colonisation for both the Greek world and others (Romans, Inka, etc.) it is surprising that current archaeological theory is still unable to firmly settle on the idea of what constitutes a colony. In the presence of historical documentation the identification of a settlement as a colony is slightly more secure, as there are historical records which describe it as a colony and give at least one tidy myth for its foundation. For these 'known' colonies there is still the issue of how they developed and functioned (Stein 2005:4).

We have already seen that the textual sources which provide information as to the name, location and foundation of Greek colonies may not always be strictly accurate. There is even less information (that is to say, practically none) as to the day-to-day function or organization of colonies, particularly in their early periods.¹. There has been little doubt placed upon Greek settlements in the Mediterranean being colonies because that was a handy term for them, and seemed to fit with later Greek descriptions (van Dommelen 2005:11). The problem with the identification of colonies

¹For the Greek colonies in southern Italy one of the most verbose sources on this subject was Thucydides, who gave great detail on the function of colonies several centuries after their development. Provided that scholars can verify his remarks regarding the colonies of Magna Graecia this still fails to inform us as to the function of these colonies in the time between their foundation and Thucydides' remarks

in the archaeological record is that even those settlements for which we have Greek textual sources lack identifiable foundation layers, and are often preceded by indigenous settlement on the site which may or may not have contributed to the birth of the 'colony' (Stocker 2009:154).

What then is a colony? A colony could be described as a settlement in a geographical location whose plan, architecture and material culture are the same as those of a parent culture in another geographical area (Stein 2005:14). This seems a logical enough assumption for the identification of a colony - aside from several salient points. For starters, no single 'colony' of Magna Graecia (or the eastern Adriatic) contains a site plan, architecture or material culture which directly matches that of any given polis of Greece. They are rather a jumbled conglomeration of styles and traditions of several regions of Greece which form their own regional style (Owen 2005:7).

The other problem is that this distinct local flavour is found in settlements known to have at least originated as indigenous (Antonaccio 2001;127; Antonaccio 2007:200; De Siena 1990:80). This 'Greek' design and material culture were previously taken as indicators of a colony. In recent decades the identification of sites such as Morgantina and Incoronata with Greek 'design' (for want of a better term) and indigenous beginnings has led to a re-evaluation of their ethnic assignation. The presence of this style then does not necessarily declare the settlement to have been populated by Greeks any more than the presence of Ikea furniture and Volvos makes an area Swedish. So then, if we cannot trust the layout, architecture or material culture of a site to identify it as a colony, what then distinguishes a colony? The answer after several decades of argument is still awaited. Even the nature of Greek textual sources does not necessarily draw a distinction between these settlements and other movements of the population (Wilson 2006:29).

Greek colonies in Magna Graecia and the Adriatic are considered colonies *a priori* on the basis of their mention by ancient sources without much contestation of this terminology. If we examine these 'Greek' settlements without bias derived from textual sources we have a series of roughly contemporaneous sites with generally similar trends in design and material culture in a given geographical area. Some of these settlements presumably housed persons of Greek (or at least hellenic, see previous chapter) descent and some settlements housed persons of indigenous descent. It is likely that many settlements housed both categories of people in various mixtures. We cannot by any standard separate colonies from indigenous settlements (even with historical references) and we cannot with certainty declare that these Greek settlements were colonies in the
modern understanding - which owes too much to the more state-organized Roman *coloniae* (see below). From the viewpoint of colonisation studies for ancient Greece, textual sources occupy an ambiguous position. They tell us very little which cannot be either supported or discredited from archaeological data, and serve only to give very approximate and heavily debated foundation dates, foundation myths which may or may not have a basis in historical circumstances, and names.

Following this line of thought, it seems prudent in this investigation of Greek colonisation to do away with the loaded and uncertain term 'colony' and retreat to the much safer (from a theoretical point of view) discussion of Greek 'settlement' of Magna Graecia and the Adriatic (Shepherd 2009:16; Sommer 2011:185). The problem with this terminology, however, is that not only does it make Greek 'colonial' expansion cumbersome to discuss, it fails to distinguish terminologically between Archaic Greek settlements 'outside' of the Aegean and an equally large number of settlement foundations within what we traditionally today think of as 'Greece' (Malkin 2011:52). For the purposes of this discussion, then, both terms - settlement and colony - will be used interchangeably at present, as we conceptualize how best to clarify 'colonies', 'colonisation' and 'colonialism'.

As settlements with Greek overtones cannot be securely identified as 'colonies', the tone of this investigation turns to a search for what makes Greek settlements Greek, and what can we infer as to the interaction between identified settlements and seemingly non-Greek and therefore presumably indigenous sites in the vicinity? If we consider the status of settlements such as Morgantina and Incoronata, which are presumed to have been either Greek sites with indigenous antecedents or indigenous sites with Greek material culture, we then come to the interesting question of whether the presence of persons of 'Greek' origin is required in a location for it to be considered a colony. If we consider that, in the absence of textual sources, the identification of a Greek colony seems to be based most strongly on the presence of Greek artefacts and architectural styles; what we are really tracking is the movement of Greek material culture. Is it necessary for Greek persons to have accompanied this material culture into a given settlement for it to be a colony? If we consider this point, then what is actually tracked in examining the process of colonisation is the colonisation of Greek material culture. If this is the case, then Incoronata and Morgantina are surely Greek colonies.

If what is being tracked, however, is the movement (via settlement) of corporeal Greeks and their presumed ideas of their own ethnicity and culture then the vote is still very much out on what is a colony, and how we can identify them. As has been discussed above, the concept of Greek colonisation, without a consensus as to what it meant to be 'Greek' or how we consider 'colonisation' is of little utility. If we consider colonies to be those areas with an abundance of Greek trade goods, then a large area of the Mediterranean would have been under Greek colonisation. Conversely, the Dark Age and early Archaic period of Greece known as the 'Orientalising' period would be a case of Persian or at least eastern colonisation. A theoretical path interpreting colonisation taken along trade evidence quickly becomes a very slippery slope. It is not sufficient to consider importation of Greek goods into settlements as colonisation if one arbitrarily selects only Greek goods in otherwise non-Greek settlements. By such a process, all intensive trading would have to be considered colonisation regardless of which culture is importing from which. While that would make colonisation studies more interesting, it would be somewhat counter-productive to our understanding. Therefore, we must consider colonies to be settlements of actual Greeks and not simply trade goods. Colonies, in other words, must be comprised of colonists. Rather than lumping all 'Greek' material culture together as indicators of colonies we should as researchers make a point to separate those items of trade from material culture which moves with actual Greek individuals. The specifics of this division is no doubt to be hotly argued for decades to come, but should be considered nonetheless. Colonisation as a process cannot be debated without a clear indication of the starting term - what constitutes a colony.

As previously argued, the movement of domesticates would in these periods be indicative of the movement of people and not of trade. Therefore identification of varieties of domesticates might then allow us to differentiate colonies from areas of trade. If we combine the assumptions that colonies are areas of settlement in foreign shores by persons or groups from Greece, and that the translocation of livestock refers to the movement of persons or groups of people, then the presence of Greek livestock varieties translocated to sites could provide evidence for their assignation as colonies. This is not to say that the presence of Greek livestock varieties would in itself identify a site as a Greek colony, but rather that it could become part of the body of supporting evidence (other material culture, architecture, textual references, etc.) for the identification or refutation of a settlement as a colony. With regards to indigenous sites with Greek artefacts - such as Incoronata and Morgantina - the livestock varieties present could also be used as evidence for indigenous creolization or re-appropriation as a colony. The identification of livestock varieties of a wholly Greek

nature at such sites would provide an argument for their identification as colonies. If, however, livestock were to be entirely indigenous in its identification, or showing some signs of a mixture of varieties, this could be an argument for the selective appropriation of Greek material culture in an indigenous context such as argued for by Dietler (2005:63) and others (Antonaccio 2001:127).

4.1.1 Colonies: Origin of the Term and Theoretical Confusion with Roman *Coloniae*

Despite the use of the same term, Greek and Roman colonies were as different as night and day in structure and function. Roman *coloniae* (the word from which we get the term 'colony') were instituted and maintained as units of territorial control with the expansion of the Roman empire (Alcock 2005:326). In contrast, what we traditionally think of as Greek 'colonies' were largely founded in the Archaic period and were very much not part of the expansion of a single state. It has been argued above that Greece in the Archaic period was by no means a unified state. Even in the Hellenistic period, the unified nature of Greek poleis is open to debate. The poleis of the Hellenistic period were bound together in alliances and groupings around religious or militaristic needs, and were never a unified hegemonic state in the sense of Rome. Roman colonies can in many ways be thought of as satellites of Rome, Greek colonies were for the most part simply settlements with more-or-less hellenic cultural assignations which identified themselves with Greece and their Greek mother cities only so far is it was necessary or convenient.

As we have a great deal more texts surviving from the Roman period, investigations of colonisation in the Roman period have largely confused investigations of colonisation in the Greek period. The two approaches to colonisation cannot be said to have been identical, or even similar. Connotations of colony and colonisation resulting from investigations of the colonisation process and the role of colonies in the Roman period significantly hamper investigations of Greek colonisation. One cannot take the components of colonisation from one culture and simply superimpose them upon another and assume that they will marry up. It is now largely recognised by those investigating the theoretical approaches to colonisation as a concept that colonisation is too complex and varied a topic to have only a single overarching framework of investigation and understanding. Instead it is necessary to investigate the 'colonisation' process in each culture independently. Unfortunately, such an investigation falls at the first hurdle, the lack of a more appropriate term for the process of foreign settlement than 'colonisation' and for such settlements as 'colonies' tends to lead to a generalisation between the processes of Greek, Roman, Inca, another known state level societies in which such settlement is seen (Purcell 2005:133). If the terminological baggage of 'colony' is cast aside, the settlements of ancient Greece can be considered independently of other historical or archaeological colonisations.

In the interest of better understanding Greek colonisation, as well as ways of investigating the process of colonisation in other cultures, it is necessary for this study to do away with the theoretical confusion associated with the term 'colony'. For the purposes of this study, a 'colony' need only to be a Greek settlement outside of Greece. No associations of territorial control, panhellenic involvement or inter-poleis alliances need be brought into the discussion at this point in the sudy of colonies. This study seeks only to examine the identification of colonies in both historically 'known' (from texts and excavation) and contested sites in two areas of settlement outside of Greece. The point behind this type of controlled comparison is to assess just how similar the colonies were in the reasons for their foundation, structure, settlers, subsequent development and where differences emerge and why. If the goal is to seek broad cross-cultural correspondences in colonial situations, it might seem a curious choice to focus on roughly contemporary, geographically proximate colonies of the same cultural system. Yet such a comparison might provide a more refined test of just what is common to being a colony, or of just how far a quest for regularity may be an *ignis fatuus* (Alcock 2005:300).

4.2 The Colonial Environment: The Concept of 'Hellenization'

The traditional view of Greek settlement outside of the geographical area generally considered as Greece has been termed the process of 'hellenization'. To put it briefly, hellenization entails the organized relocation of a segment of the parent population to a new area, where they created a miniature but faithful reproduction of the parent civilization. This parent civilization, continued on in its infant colony, spread from the colony to the indigenous groups by means of its inherent 'superiority'. The moral, technological and cultural 'superiority' of the colonizers was so great that the locals wholeheartedly accepted civilization and adopted the material culture and customs of the colonizers. Some cantankerous indigenes may have brooked opposition to the removal of their traditions, but they were quickly overcome by the sheer overall might and wisdom of the

colonizers. These indigenes then either lived happily alongside the colonizers or married into the community (the women, generally, who moved into the colony and thus more effectively eradicated the indigenous culture by the absence of indigenous children to carry it) and the colony grew, increased in size and spread itself out across the landscape into further colonies (Owen 2005:6; Stocker 2009:182). Within a few generations, the indigenous group or groups had been completely absorbed into the new superior culture and the region began its expansion into colonies in another locale. This traditional approach to the colonisation process is - in essentials - eerily similar to the process of viral infection, with the immune system of the host geography generally putting up a very poor fight. This spread of viral civilization is in many ways taken as inevitable - a natural outcome of colonisation so certain that until the last few decades few scholars bothered to look seriously at the actual theory and process (Babić 2007:82)

The viral approach to the concept of colonisation generally termed hellenization came about as the result of several factors. One of these was the practice of approaching this process largely or only from the point of view of the colonisers. This practice resulted from the assumptions of classics, and thereby classical archaeology, of classical Greek culture as the cradle of European civilization. This viewpoint necessitated an interest in this ancestral Greek culture as the Prometheus of civilization and all that was good in material culture (Owen 2005:12; Babić 2007:82). This is a florid description but unfortunately a correct one. Greeks and the later Romans were (and in many ways still are) so appealing to western archaeologists and classicists that their superiority even in the Mycenaean period was a certainty so strong that it need never be actually investigated. This has largely changed, but the idea of Greeks as central actors in the ancient world still clings to the edges of classical archaeology (Babić 2007:83).

Another contributor to the disjointed approach to colonisation was its recursive interpretative relationship with European colonisation and imperialism of the sixteenth to twentieth centuries (Rogers 2005:338). The historical 'age of colonisation' both modelled itself upon and led to interpretations of the process of ancient colonisation (Dietler 2005:34). This more modern period of colonisation and imperialism occurred around the same time as a resurgence of interest in surviving texts of Roman and Greek culture. By both over-interpreting surviving texts of the Greek post-Persian War fear of the barbarian and directing modern (or at least historical) prejudices against indigenous 'uncivilized' societies of 'the foreign', historical imperialism and colonisation drew on

and from a jumbled mix of Greek colonisation and Roman imperial expansion to create an analogical bridge to nowhere (Snodgrass 2005:56). In other words, ancient texts were used to a greater or lesser extent as a model for the more modern age of colonial expansion and imperialism by European states, which then led to the later interpretation of Greek and Roman colonisation through analogies to more modern forms of colonisation - such as European state colonial expansion and imperialism.

Whatever the actual opinions of Archaic settlers on foreign shores, and whatever their interactions with indigenous groups, the hellenization theory grew as a by-product of interpretations made by a colonising empire as well as a desire to ground modern-day injustices in the superior cultures of the past (Rogers 2005:337). This was assisted by the fact that antiquarians, culture historians and modern archaeologists (as well as classicists from all periods of modern research) have received a one-sided argument of ancient Greek colonisation from texts left by ancient Greeks. The *ktiseis* or foundation myths which survived were written by Greeks and contain a distinctly Greek point of view (Stocker 2009:179). The fact that many or most of these were recorded well after the development of the colony in question, and served their own various aims in their choice of description (and whether or not to mention indigenous groups), was generally ignored in their interpretation. This historical context (of colonisation) combined with the one-sided argument of Greek texts combined together to greatly assist in the creation of the deep misunderstanding of protohistory that is the viral concept of hellenization. Hellenization (or romanization or other cultural -izations) was a simple theory which fit the ideas of its time. An example in the problem of uncritical interpretation of ancient sources seems helpful here: ancient Greeks believed and recorded in texts that the Danube river emptied not only into the Black Sea but also into the headwaters of the Adriatic - at least until the fourth century BC when they seem to have given up looking for it (Stocker 2009:29).

The reliance of classical archaeology on ancient textual sources is the result of their presence. If there were no textual sources relating to the ancient Greek colonies, then the interpretation of colonies and colonisation would have begun more directly from existing archaeological remains. The presence of historical texts is of great value in that they provide information on ancient interpretations of these settlements and their environments (both cultural and physical). Their benefit lies in informing archaeologists as to the view ancient Greeks had of themselves, their history and their world (Owen 2005:8). They do not necessarily tell us accurately when colonies were founded

or by whom but rather the propagandised history of colonisation which the whims of the author (in his historical environment) wished to relay. They are the press clippings of the ancient world and deserve scholarly perusal, but with a hefty amount of scepticism.

Accounts such as that of Thucydides can, however, be compared with archaeological evidence to give (when carefully examined and compared with archaeological material in an unbiased way) a more colourful and detailed interpretation of that archaeological evidence. The failing of textual sources is seen in the now outdated bias in their favour when this process was carried out in reverse (archaeological enquiry used as a means by which to provide artefactual and architectural colour for texts). The essential view of Greek colonies has arisen from a poor understanding of ancient texts. There is some little evidence (several centuries after overseas settlement began) of enforced subjugation of indigenous groups; this was previously misinterpreted to imply a Greek dominance over the natives from the earliest days of colonisation (Owen 2005:13). They have also interfered with interpretations of the colonies themselves. Early excavators of classical sites knew all about the cities they were excavating from textual sources, and so there was no need to carefully check these sources against their findings. The tendency to continue this view today can be seen in the often all-too-heavy bias on textual sources for the interpretation of artefacts as opposed to detailed interpretation of excavated material and layers prior to the use of textual sources in interpretation. To use a worn out and over applied metaphor from Suetonius (The Lives of the Twleve Caesars 333), they are the "wolf held by the ears" which we can neither ignore nor fully rely upon.

4.3 Greek Settlement Abroad: a Theoretical Approach to Colonisation and Interactions

If we consider the idea of hellenization - and indeed of the colony - as being done away with, we are left with a gap in interpretation for foreign settlement and resultant interactions. With the dissolution of the idea that cultural dominance was an intrinsic feature of colonisation has come a variety of concepts centring on the idea that two cultures brought into close contact will jumble themselves together to create a third. This idea is variously known by such terms as 'creolization' or 'hybridity' to describe the third (or, in some cases, fourth or fifth as well) culture that arises at the boundary of different groups (Antonaccio 2007:202). This uses the interactions between groups to argue that material culture in one society does not necessarily take a top-down approach and move

wholesale into another group. Some elements of a culture can be adopted and others disregarded. Adopted elements are not necessarily given the same cultural significance in the adopted culture as they had in that of their manufacture (Antonaccio 2001:127). A good example of a modern study of hybridity is that of Dietler (1990; 2005; 2010) in the southern Rhône basin of France. While not strictly a study of hybridity, his investigation of the specific appropriation of Greek wine drinking paraphernalia (and wine) into the groups of the Rhône basin provides a good example of the directed appropriation of specific classes of material culture to integrate into an existing cultural framework - in this case, status drinking (Dietler 2005:63).

Studies of interactions such as this also tend to expound upon a highly significant point which was completely missed by the concept of hellenization - people are idiosyncratic. This point is not stated as such, rather it is generally agreed in recent studies of cultural interaction that interactions and outcomes (material culture appropriation and alteration, as well as relations themselves) are not standardized across all of pre- and protohistory. Interactions between any two groups are likely to be as diverse as - well - any two groups (Rogers 2005:338). People vary from person to person, and interactions between cultures are first and foremost conducted between people. It therefore follows that interactions between those groups of persons which we in archaeology term cultures should reflect the individuality of those individuals involved (Hall 1997:29). No single theory of interaction can apply in all cases, no matter how much the theory would like them to (Schrieber 2005:245). The simple outcome of decades of argument over the theory of settlement and cultural interaction has been the decision that it is not simple at all and each case should be examined before determining the outcome (Antonaccio 2005:110; van Dommelen 2005:119). Rather than using archaeology to provide illumination and context for interpretations gleaned from historic texts, we should use archaeological inquiry and evidence matched with historical, ethnographic and ethnoarchaeological data before making interpretations about the process of Greek 'colonisation' and 'colonial' interactions (Lucy 2005:101). It is also important to consider that these various interactions between settlements, or cultures, or individuals (or however it is seen in the archaeological record) are no more static than they are homogeneous. Interactions between groups and the significance of traded objects are constantly changing, and it is necessary to incorporate this change into interpretations. An artefact category can - from the point of view of archaeology - have multiple meanings and uses simply because the time scale of archaeology is much greater than the day-to-day changes of lived experience (Stein 2005:30).

As the usage and discussion in this chapter of the terms 'colony', 'colonial' or 'colonisation' may indicate, it is impossible to discuss Greek settlement of Magna Graecia and the eastern Adriatic without some reference to these loaded terms. In order to simplify the theoretical load upon the terms colony, colonisation and colonial, they are to be defined hereafter as follows:

Colony: a settlement of persons of a given cultural group distinctly outside of the boundaries of that cultural group;

Colonisation: the movement of individuals or groups of individuals from their native cultural area into an area geographically outside that of their cultural group and occupied by persons of another culture; and

Colonial: the geographical area around a colony; also the interactions between colonists as well as between colonists and indigenous groups in the geographical colonial area.

In considering studies such as that of Dietler in the Rhône Basin it is also worth remembering that the movement of material culture does not necessarily imply the movement of people or of culture into new areas (as discussed earlier in this chapter). Trade interactions in the Mycenaean period would not be realistically argued to be indicative of settlement of southern Italy or the Adriatic coast, nor would they be argued to be indicative of colonisation. It is by separating these two points (settlement and colonisation) here that we return to the inquiry of whether colonisation necessitates the movement of people or rather of goods and ideas. It is easy to identify the movement of goods with an appropriate analysis. Likewise is it possible to identify the movement of people, but ideas leave fewer archaeological traces. We assume that the movement of both people and material culture implies the movement of ideas (of culture), but it is more difficult to argue for the movement of one without the other. For the purposes of this investigation we shall use the approach that Archaic period Greeks were not engaging in settlement abroad in a rigidly organised manner under the direction of city-state authority. We shall not assume that indigenous groups in the vicinity of Greek settlements were subjugated, nor that they were eager to acquire wholesale Greek culture. Instead we can move from the premise that individuals or groups of individuals migrated to new and expanding settlements in foreign lands. In these settlements there undoubtedly were interactions of some form with local groups. Through these interactions at least some aspects of Greek material culture were traded into local groups and were presumably incorporated into an existing cultural framework. As to what goods and ideas were traded from local groups into Greek settlements we are less clear. For the purposes of this inquiry, it is assumed that the two cultural groups living in close contact must have had some form of contact. As to how these groups merged and mingled will be investigated in the following chapters.

In attempts to identify domesticate varieties from the cultures and regions in this study, mixed livestock signatures, as previously mentioned, could be indicative of interaction between colonies and local populations. It has already been argued that indigenous groups in the vicinity of colonies (or in interactions with foreign cultures) can and often do appropriate material culture to suit their own needs and desires (Antonaccio 2001:127). Mixed livestock variety signatures at indigenous sites contemporaneous with colonies need not be indicative of 'hellenization' in action. A mixture of livestock varieties, or livestock of a mixed variety (as a mixed signature could be indicative of either instance) is as likely due to interbreeding or communal pasturing of herds, trade in live animals (or meat) between communities, as well as a number of other arguments which will undoubtedly be broached in future.

In the following chapter the unique suitability of livestock will be considered for the investigation of colonisation and the identification of colonies. In conjunction with the aim of identifying cultural or regional varieties of domesticates, colonisation is also ideally suited to determine if such varieties can be identified. It is in the context of colonisation that we have groups from two geographically distinct areas and cultures coming into sustained contact. This provides a prime arena for attempting to identify livestock varieties associated with these regions and/or cultures. If these varieties can be identified (as is hypothesized based on the evidence given in the following chapter), their movement or lack thereof with colonisation can aid us in the identification of colonies and interactions with indigenous groups.

Chapter 5

Bones of Clay: Animals as Material Culture

We (in Germany and in German-speaking Central Europe) are trained first morphologically, second morphologically, and third morphologically. We are trained mainly morphologically and ecologically. Now it is our problem that we have in Germany some schools which never go out of that field and can work only zoologically and have not found out what the archaeologists want ... These people were working only in lists and in such lists we find nothing ... If you know the bones really [and] can see every bone more than "it is the bone of a horse, it is the bone of a donkey, or it is the bone of a sheep", if you can see the muscle marks – this muscle mark is so big because it is a male and an old male and this muscle mark is smaller because it is a female and a younger one and so on – if you know your material in this manner, you can work. If you do not, you cannot work. [J. Boessneck, 9 May 1975.]

The analysis of faunal material recovered from archaeological sites is by no means a new or novel approach. Faunal assemblages have been identified and analysed for over a century. The vast majority of this analysis has focused on examining provisioning patterns in the archaeological record. That is to say, the main interest in the examination of faunal materials has been to examine the techniques of hunting and butchery practices in the Palaeolithic, Mesolithic and later periods. With the onset of the Neolithic, zooarchaeological inquiry has continued these trends of provisionment examination with the addition of investigating the process or morphological change in animals with domestication, as well as the spread of mammal and later avian domestication (Redding 2006:42). Faunal analysis has also been used extensively to study herd management practices through the examination of age-at-death and sex profiles (Marom and Bar-Oz 2009:1184; Vigne and Helmer 2007:21). Studies have largely focused on the animal bones as a proxy indicator of the relative proportion of meat consumed from various taxa, on arguments for or against the utilisation of secondary products and on the nature of domesticates. In the investigation of domestication, changes in size and overall morphology (as well as detailed analyses of particular elements such

as horn cores) have proven critical in examining the domestication process (see for example, Zeder 2001).

It is this morphological examination that changes faunal material from a proxy for meat to an artefact of material culture. Domesticated animals generally vary in size and shape from their wild relatives (Zohary et al 1998:132). This is a basic principle of domestication, although its causes are still little understood. Domesticates vary in form from their wild relatives due to the stresses imposed upon them not only by their environment, as with wild animals, but also by those of the domestication environment. Under domestication, humans form the main selection pressure for the breeding group, causing changes in the domesticated animal. These changes vary depending on the species under domestication, but often involve a shortening of the cranium (seen in foxes, dogs and pigs, among others) and a reduction in sexual dimorphism (Arbuckle 2006:24). The important point to make here is that with the change from hunting of wild game to the keeping of domestic livestock, domesticates are *kept*. Their lifespan and breeding patterns are under human control to a greater or lesser extent. Individual variation decreases markedly from that of wild animals, including both variation in animal size, sexual dimorphism and bodily proportions (Boessneck & von den Driesch 1978:26). This variation is less than that of wild animals of the same genus, but is still present. The keeping of domestic animals involves choices from the composition of the herd to the culling of excess breeding animals (involving decisions as to which ones to keep) which may either involve a conscious selection of individuals for desired traits (size, wool, temperament, health, etc.) or a random selection of individuals (Arbuckle 2006:19). In either case, the nature of selection in the management of a herd has the potential to cause changes in the overall form of the livestock over time (Reitz and Wing 1999:281; Zohary et al 1998:129). As local groups of wild animals vary slightly across regions due to local selection pressures so should domesticated ones.

In the case of domesticated animals, the selection pressures are the result of humans. Therefore, it is hypothesized here that local (either regional or cultural) groups of domesticated animals will form slight but significant variations, or varieties. As breeding groups, domesticated animals form small pockets of genetic isolation overlapping between the different but related breeding herds of a culture or region (Reitz and Wing 1999:67). The distinction is made here between cultural varieties and regional ones, as some cultural areas covering large regions may not necessarily interbreed livestock over the entire area of the given culture, and some regions may see interbreeding of live-

stock between archaeologically identified cultures. In genetic isolation (or at least near-isolation) caused by human management of domesticated animals, a regional group of domesticates for a given taxon will change over time to become a regional variety of that domesticate. It is in this way that the breeding pressures of domestic animals have caused them to be likened by zooarchaeologists to those of island taxa (Clutton-Brock 1999:245; Reitz and Wing 1999:293). They are genetic rather than geographic islands. Island populations of animals have been shown to produce rapid morphological changes; so too can domesticates (Arbuckle 2006:25; Millen 2006:1867).

As was seen in the fox farm experiments in Russia, controlled breeding was able to cause phenotypic (visual) changes in wild foxes within as little as ten generations (Trut 1999:164). Within thirty years, small but significant percentages (over the non-'domesticated' population) of foxes were born with floppy ears (0.035%), curled tails (1.033%), shortened tails (6.9%) and coat colour mutations (1.646%) (Trut 1999:168). Seventy to eighty percent of the population - bred only for sociability to humans - was tame; actively soliciting human contact and attention (Trut 1999:163). The morphology of these foxes also changed, with a reduction in the length of the snout and a decrease in the sexual dimorphism of skull shape (Arbuckle 2006:21). Modern breeding of domesticates, with dogs as perhaps the most popular example, can demonstrate over three hundred varieties of domesticated dog, many of which were developed within a few decades. It is not argued here that livestock in antiquity were bred under the same strict selection pressures for size, shape or temperament that brought about modern dog breeds. However, the many and varied forms of domesticated cattle across the globe provide good evidence that changes in form would have been possible in antiquity even without conscious selection for breeds. A desire for livestock which survive droughts, hard winters or rough terrain, or for livestock which produced more milk, better cheeses or longer fleeces would have been sufficient to cause changes in an inter-breeding group within a few decades or centuries (Davis and Beckett 1999:10; Trut 1999:164).¹ As will be seen below, these characteristics were already noted and in demand at the very least in ancient Greece.

Any examination of domestic taxa needs to consider the fact that animals kept and maintained by humans are in effect not simply allotments of meat and secondary products held upright by bones

¹Alternatively, the segregation of a breeding group from other animals of its species (in other regions or culture) could over time cause morphological variations within that group. The recognition of variation in the size and shape of domesticates between different cultures or regions would not necessarily indicate the presence of intentional breeding of livestock. This study focuses on the possible identification of varieties, the intentionality of their development will be left for future research.

but are in fact material culture in and of themselves (Uerpmann 1973: 317). In much the same way as clay is shaped and fired to form a ceramic vessel, domestic taxa can be shaped by the needs and desires of the individuals or culture to which they belong. To carry the analogy further, it is not the clay itself but the form and function of the vessel that is analysed as a cultural artefact. In the same way, it is not the recovered element but the overall variation in size and shape of the recovered faunal material that forms a component of material culture. When considering domestic taxa, it is necessary not only to compute dietary proportional representation and herd culling profiles but also to consider the size and shape of the domesticates of a given site or of the known sites of a culture. Comparisons of domesticate morphology between sites considered by other categories of material culture to be of the same cultural group can elucidate similarities or differences in the management of livestock (Davis and Beckett 1999:8). These differences can demonstrate if domestic taxa were interbred between sites, if animals of a given taxon were being bred differently or for a different purpose in one site but not in others, or if livestock from a given group were relocated to sites in a different area (Dobney 2001:39).

Essentially, the choices made in the keeping of domesticates may cause small but identifiable changes in the size and/or shape of the recovered faunal remains. Changes in the size and shape of domestic animals need not be undertaken intentionally. The formation of 'improved' breeds and selective mating seen over the last few centuries was not necessarily in occurrence in prehistory. However, even random selection of individuals within a regional breeding pool of domesticates can - over time - cause measurably significant changes in the size and shape of the given domesticate (Zohary *et al* 1998:132). It follows that these 'measurably significant' alterations in form are generally identifiable through a careful examination of the osseous remains present on archaeological sites. As these changes are the product of human maintenance of the domestic livestock, the morphological data from the domesticates of a given site can therefore be considered a component of the material culture of that site. This material culture should be given ample consideration, as one would any other category of material culture (lithics, ceramics, metalwork, etc.).

5.1 On the Importance of Biometry

If we consider the argument that animal bones recovered from archaeological sites can be considered as a category of material culture, it is worth discussing the ways in which the material culture patterning of faunal assemblages can be deduced. Aside from the traditional techniques of intrasite and inter-site comparison looking at taxonomic ratios and culling profiles, there is also the traditional but still woefully under-utilised technique of biometrical analysis. Biometry (from an archaeological perspective) is the measurement of animal bones and teeth. Standard measurements are available for each taxon, generally following those laid out by Angela von den Driesch (1976). The use of standardised measurements allows for greater comparability between measurements taken from different sites and by different researchers.

Unfortunately, interest in biometrical analysis has still been largely confined to within zooarchaeology, as opposed to a wider usage within archaeological inquiry. With regards to some areas of prehistory, zooarchaeology and biometrical analysis are given a more valued place in keeping with their potential contributions to archaeological understanding, such as examining the onset and spread of domestication in the Neolithic or the improvements in domesticates in the Roman Empire or in Medieval Europe (see for example Albarella 1997; Albarella, Dobney and Rowly-Conwy 2006; Albarella and Payne 2005; Arbuckle 2006; Arbuckle and Makarewicz 2003; Crabtree 2007a; Cucchi et al 2011; Davis and Beckett 1999; Duru and De Cupere 2003; Lepetz 1996; MacKinnon 2010; Thomas 2005; Zeder 2001; Zeder 2006). With regards to the several millennia in between, however, biometric studies must still fight tooth and nail to prove the value of their potential contributions to archaeological inquiry (Dobney 2001:36). As zooarchaeology has a larger role to play within the practice of archaeological research, so biometry has a larger role to play within zooarchaeology through a greater application to both zooarchaeological and archaeological analyses of sites and cultures. The recording and comparison of measurements of bones from archaeological assemblages not only allow for the differentiation between closely related species (such as the horse Equus caballus and the ass Equus asinus), between wild and domestic forms, or between sexes of a given species, but can also be utilized to examine the scale of individual variation within an assemblage, or the changes in animals of a given taxon over time or across space (Boessneck & von den Driesch 1978:25).

Biometrical analysis uses several techniques to examine changes in size and shape. The most basic form of analysis is a comparison of WRH or height at withers (*Wiederristhöhe*) of domestic taxa. This calculation of the estimated height of living animals uses the measures of overall length of specific long bone elements for which multiplication factors have been identified in previous



Figure 5.1: Height calculations for basset hound (20-35kg, c.35cm WRH) and basenji (11kg, c.40cm WRH). Height and weight estimates are given according to the Kennel Club (2011) breed standards.

research (i.e. von den Driesch and Boessneck 1974). This technique provides a simple means by which to compare populations (through their archaeological assemblages) by means of overall height. Height comparisons provide a broad idea as to changes in animal size between sites or between periods of the same site, but are limited in that they only consider changes in overall height and not in the shape of the animals. It is entirely possible that two distinct varieties of domesticate can have vastly different shapes and still register the same height, as shown in Figure 5.1. In order to account for differences in shape, biometric studies often routinely include a comparison of articular surface breadths as well as a comparison of length measures between bones of the same taxon (and assemblage) (Albarella 2002:56). The most common way to identify shape variation in identified elements is through bivariate comparisons (two or more measures of the same element: see below and appendices), which can show changes in the shape of that element between sites or periods. This is an improvement upon the simple calculation of WRH, but (as with WRH) requires a large sample size to gain significant insights into proportional or population variation.

To increase the utility of smaller assemblages a complementary investigation of shape variation is conducted using one or more size index scaling techniques, such as the Log Standard Index or LSI (see Section 6.3.4 for more detail). Log index scaling techniques translate raw data values for the measures of animal bones into ratios of variation in size and shape from a standard animal or population of animals. Several techniques can be utilized to standardize measures of bones, the most common being the Log Standard Index or LSI using the formula log(x) - log(m) where x is the measure of the archaeological specimen and m is the corresponding measure of the standard animal or population mean.

These techniques have gained popularity during recent decades with improvements in computer modelling and statistical software allowing for faster calculations and graphing of the more complex comparisons (Albarella 2002:51). Size index scaling techniques convert the 'raw' measurement of a bone into either a ratio or calculation of size deviation from a standardised measure (Meadow 1999:287). In this way measures from different bones (for example, the length of a metacarpal and the distal breadth of a tibia) can be compared directly against one another to determine changes in shape. This technique, along with crossplots of raw measures, allows for the identification of the scale of individual and sexual variation within an assemblage. In any comparison of assemblages between sites or periods it is necessary to have a good understanding of the range of individual and sexual variation for each assemblage so that they can be meaningfully compared with others (Boessneck and von den Driesch 1978:28). Sexual dimorphism and individual variation are most easily observed with larger sample sizes, and so assemblages often require some form of size index scaling. In such studies, it is important to distinguish between standardizations or ratios for measurements on different planes (length, depth, breadth, etc.) in order to retain information on animal shape as well as size. This technique allows for the pooling of smaller sample sizes to facilitate comparisons between domesticate size and shape of different sites or periods. These techniques form an excellent complement to comparisons when used in conjunction with raw measures (Albarella 2002:55).

Biometric recording is simple, straightforward and rapid when done in conjunction with more commonly applied techniques of faunal analysis. The recording of biometric data is already commonplace in many zooarchaeological analyses, but is generally under-utilized. The hypothesis that regional or cultural varieties of domesticated animals can be deduced from biometric data, backed up by previous studies indicating regional or cultural 'improvements' to livestock on the basis of biometric data (see below), has great merit for the field of zooarchaeology and of archaeology as a whole. If we consider the idea that domesticated animals, by virtue of human management (creating varieties), are a category of material culture, and the idea that these varieties can be identified and measured, then the possibilities are if not endless then certainly very broad indeed. Biometry has already proved itself valuable to an examination of Neolithic domestication and Roman and

Medieval variation in domesticates. There is no definite reason why biometric evaluation of regional and cultural varieties of domestic animals could not and would not provide a great insight to the archaeological inquiry of the vast period between these current areas of study (Neolithic and Roman/Medieval). Faunal analysis may be an old technique, but that is no reason why it should not be pushed occasionally into new frontiers and made to show - once again - its virtue to archaeology.

Changes across time and space between sites can answer questions not only about stock management practices for a given culture but can also be refined to examine other archaeological questions, such as the nature of contact and colonisation. For example, a significant change in the size and shape of a taxon between two occupation phases of a site could be indicative of 'improvements' in that taxon; it could also be indicative of the appropriation of a different variety of that livestock at the site (Crabtree 2007a:167; Davis and Beckett 1999:10). How to test for this? Without a biometrical assessment of the size and shape of domesticates at a site such a change would not be noted (unless perhaps this biometrical change was of the degree seen between a chihuahua and a great dane, and therefore distinctly obvious to the naked eye). However, this biometrical data of changes in a domestic taxon at our hypothetical site - while interesting - provides little understanding in and of itself. It is only through an assessment of the biometry of domesticates at multiple contemporaneous sites in a region or cultural area that the domesticates of this site could be placed into context. Only when our hypothetical domesticate biometric profile is compared to these other sites can we see if this change is seen at all sites at the same time, is seen first at this site and then at others, or is distinct only at our site. If we consider the change in domesticate biometry at our site as 'improvement' to the previous livestock variety, is this seen at other sites in the area? What changes can be seen at other sites in the area during this period? If we consider this change in biometry to be the product of the introduction of a new variety, where did it come from? Changes in the preference for one domesticated species over another at a site or several sites in one area provide great information to zooarchaeologists and archaeologists as to the economic provisioning of the site and area. Changes in the domesticate biometry at a site or several sites, along with the speed and origin (geographical and chronological) of that change, can provide evidence of not only alteration in the economic needs of the area (with evidence for local 'improvements') but also of interactions both within sites of this culture or region and those outside of it (through the introduction of different livestock varieties).

5.2 Metric Changes: 'Improvements' or Movements?

If we consider, then, that domestic animals form a category of material culture by virtue of being 'shaped' by the cultures which keep them, and that variations in this 'shaping' can be seen in faunal assemblages through careful application of biometrical analysis, the next point to address is how biometry could be used to identify the hypothesized regional variation in faunal assemblages. Local varieties of domestic taxa are not as easily distinguishable as - for example - a bell beaker or a Corinthian krater. Neither are they as distinguishable biometrically as a chihuahua and a great dane. Determining local varieties and comparing them against one another is more similar to sorting a chronological sequence for undecorated utilitarian ceramics from a little-known prehistoric settlement. It is possible, but requires the layering of multiple groups of data upon one another to slowly build up a concise body of knowledge about the material so that a picture of changes over time and space can emerge. To examine domesticate varieties it is necessary to build up comparative data from many sites of both the same and different geographic and chronological locations (Boessneck & von den Driesch 1978:29).

As with ceramic chronologies, databases of domesticate morphology are possible given enough effort. As has already been stated, regional or cultural variation in livestock was theoretically in existence in prehistory, but is not necessarily obvious without careful comparison. For this, it is necessary to have data from many sites of both the same and different regions and cultures of a given period, or of the same region/culture over multiple periods. If it were the case that all archaeological site analyses were to give the same careful attention to faunal assemblages as ceramic ones, a clear picture of the location, development and movement of domesticate varieties would all ready exist. As this is not the case, then the initial building blocks of creating such a picture need be put into place for the areas considered in this study. The increase in biometric studies within zooarchaeology has already added significantly to the available data for domesticate size and shape in many regions of Europe (see for example Albarella 2005; Albarella, Dobney and Rowly-Conwy 2006; Albarella and Payne 2005; Arbuckle and Makarewicz 2009; Bökönly 1974; Davis 2000; Davis and Beckett 1999; Zeder 2001). The use of biometry and other osteometric/morphometric techniques have long been useful in studying the development and spread of domesticates in the Neolithic. Arbuckle and Makarewicz (2009) used a comparison of LSI values for cattle to determine the timing and spread

of the introduction of cattle into central Anatolia. Haber, Dayan and Getzo (2006) used changes in LSI values to trace the reduction in tooth size of pigs at Neolithic sites in Israel. Duru and De Cupere (2003) used LSI comparisons from Neolithic sites of south-western Turkey to determine the introduction of domesticated cattle at the site of Höyücek. Warman (2006) used an (geometric morphometric) Eigenshape analysis to identify changes in the size and shape of the first molar and fourth deciduous premolar of pigs under domestication to identify differences in breeding groups.

Metrical analyses of domesticate local 'improvements' or the introduction of new forms have largely been restricted to investigations of the historic period owing to the need to supplement nascent regional metric profiles with historical evidence of improvement or introduction (Davis and Beckett 1999; MacKinnon 2002:54; Thomas 2006:17). These studies also serve to supply firm archaeological evidence to support or refute historical texts or artwork representing such changes in domesticates (Boessneck & von den Driesch 1978:33). Studies of comparative biometric morphology have proven extremely useful in recent years in examining both changes and movement of animals from the historic period. Thomas (2005) used variation in LSI values to identify an increase in size in all three shape planes for domesticate taxa in the fourteenth century AD at Dudley Castle. Albarella et al (2008) looked at changes in cattle size in south-eastern Britain between the Late Iron Age and Early Roman periods. Using a combination of bivariate measures and LSI values to compare three sites in Essex (first to fifth centuries AD), they were able to show a significant increase in the size of cattle between the Late Iron and Early Roman periods and an increase in the size of sheep between the Early and Middle Roman periods. This increase was also seen in a metrical analysis of the teeth, which were together taken as evidence for an introduction of new stock rather than 'improvements' or changes in herd sex ratios (Albarella et al 2008:1836). These findings were subjected to a Mann-Whitney U test to prove the statistical significance of the observed biometrical differences. Crabtree (2007a) used a combination of taxonomic ratios and changes in the height at withers of sheep at the Middle Saxon sites of West Stow and Brandon (c.AD 600-850) in Suffolk, England to argue for wool production and the introduction of new varieties of sheep. Davis and Beckett (1999) compared measures of cattle (and sheep) tibiae and astragali to demonstrate not only regional variation in the size and shape of domesticates across England from the Medieval and post-Medieval periods, but also evidence for an increase in the size and shape of these animals between the fifteenth and sixteenth centuries (between the sixteenth and early nineteenth centuries

for sheep) through the development of improved breeds.

Such analyses as detailed above provide a means by which to track human interaction and the movement of ideas by following the movements of domesticate varieties and their improvements (Ashby 2002:4). In examining the enlargement of Roman domesticates we see a critical point to address. It is not enough to note that 'enlarged' forms of domesticates are seen spreading in sites of the Roman world. 'Large' animals is a subjective term, and so it is only through biometrical investigations that this enlargement has been properly addressed (Dobney 2001:30). In the same way, the attribution of enlarged animals at sites such as Incoronata as being imported Greek livestock by Bökönki (2010:20) must be appropriately quantified through biometrical analysis. While it is of interest to demonstrate changes in size and shape at a site from one period to another (such as with the studies of Roman cattle or Medieval sheep described above) it is impossible to distinguish the introduction of new varieties from *in situ* alterations of previous varieties unless one investigates, for example, the size and shape of Roman cattle, or of Medieval sheep in Suffolk, England. This form of inquiry was conducted by Davis and Beckett (1999); successfully demonstrating not only regional variation of breeds) over time.

If we consider the hypothesis that there was a regional variety of Greek domesticates (or domesticate, as not all domesticates may have been regionally uniform throughout ancient Greece), then the best way in which to examine this would be to identify possible lines of evidence for regional Greek varieties of livestock and to examine this hypothesis through biometrical analysis. If a regional variety of Greek livestock can be identified through biometrical analysis in the Archaic and later periods, then the associated movement of livestock (or lack thereof) could be examined to elucidate the intensity and organisation of Greek colonisation. If we combine the approaches of Albarella *et al* (2008), Crabtree (2007a) and Thomas (2005) in looking at variation over time with that of Davis and Beckett (1999) looking at variation across space it may well be possible to identify the range of variation for domesticates of a culture across time and space. Once we have identified a variety, we can look for its elsewhere. To continue with the previous ceramic analogy, if we can identify the vessel, we can then attempt to track its movements across time and space as an aspect of the material culture of ancient Greece.

5.3 Greek Farming and Stock Raising

From available textual sources it is nigh on impossible to gain a coherent understanding of stock rearing practices for Greece in the Archaic, Classical and Hellenistic periods. The few available textual sources on the management of livestock allow only glimpses of the status and utilization of domesticates in ancient Greece (Davidson 1997: 233; Margaritas and Jones 2008:159). That said, these are of some use in fleshing out the understanding of Greek domesticate usage gleaned from zooarchaeological inquiry. Unsurprisingly, the domesticate taxa kept by Greeks were the ubiquitous cattle (Bos taurus), sheep (Ovis aries), goat (Capra hircus), pig (Sus domesticus), chicken (Gallus gallus domesticus), dog (Canis familiaris), donkey (Equus asinus) and horse (Equus caballus) seen throughout most if not all of Europe. For our purposes, the mere presence of these taxa is incidental to arguments on Greek livestock management. What is of interest here is not the presence of domesticates but the variety or varieties of domesticates seen in archaeological sites of the periods. If local interests and decisions in stock rearing can be assumed to cause changes in the breeding population over time, then the livestock management of Greece is of great importance in the creation of 'Greek' taxa. The question as to the presence of 'Greek' livestock in the investigated periods is one which will be investigated in more detail in Chapter 7. With regards to textual sources on Greek domesticates, the majority of our scant evidence comes from the Classical period and is therefore too late to bear fully on the argument for Greek livestock varieties of the Archaic.

What we do have from as early as the Archaic period is evidence for the importance placed (at least by elites) on the rearing of livestock and specifically on the control of prime grazing lands (Howe 2008:58). The Lelantine War of the seventh century BC began between the Chalcidians and the Eretrians over disputed access and control of the coastal plain of the Lelas river, which was a well-watered treeless pasture (Figure 5.2). It was, in fact, the only truly suitable area for horse pasture on the island. The quality and quantity of livestock which could be reared in an area or by an individual were heavily dependent on the quality and quantity of pasture land available. From historical sources it is also apparent that livestock were a great source of wealth and status, particularly when raised intensively by elites (Howe 2008:106). From sparse references to stock raising practices in ancient texts it has been persuasively argued by Howe (2008) that the rearing of domestic livestock was a status-laden enterprise providing not only nutritious primary and sec-



Figure 5.2: Map of the Coastline Between Attica and the Island of Euboea, Showing the Location of the Lelantine War

ondary products but also products for sale or sacrifice. The value of livestock as a status commodity came from their use for the provisioning of power and influence through the hosting of sacrificial feasts (Howe 2008:101). In the Classical period we do know from textual sources that certain areas, such as Thessaly and Sparta, were known for their cattle and (in particular) horses. As most of our textual evidence comes from Classical Athens it should come as no surprise that (a) Athens was severely lacking in the verdant pasture land necessary for the intensive rearing of cattle and horses; (b) horses (both in quality and quantity) were a mark of social status among elites; and (c) Athens was best known for its sheep, which produced a wool widely known for its quality. The historian Xenophon listed the wealth of Athenian sheep ranchers before those provisioners of wine, oil or grain (Howe 2008:57). Polykrates the tyrant of Samos was reputedly so impressed with the fine quality of Athenian wool that he wished to import Attic sheep to cross-breed with his native Milesian variety. These sheep were also exploited for their milk, which was used to make cheese. Athens was also known for its fresh cheese market (Howe 2008:58).

While the existence of a notable fresh cheese market is interesting, it is the high value and reputation of Athenian wool that is of greatest interest here. By the Classical period at least we have some clear evidence of local varieties of domesticates being reared for the improvement of a desired

characteristic. This anecdote provides clear evidence for the development of local domesticate varieties in at least one area of Greece. This may have been the case in Archaic Greece as well - unfortunately the majority of surviving Greek texts describe only Classical Athens. In the case of Classical Athens it also appears that this local variety was possibly developed or at least utilized as a trade source - as a source of wool for trade (Ryder 1984:75).

This historical footnote leads us to two main points: (1) if we have evidence for regional varieties in the Classical period, what evidence is there for this in the Archaic period? (2) if we are able to identify regional varieties of domesticates in Greece, either from the Archaic or from later periods, then this would support the hypothesis that regional or cultural varieties of domestic animals can be identified in the archaeological faunal record. The note about the cross-breeding of varieties into local livestock so as to improve the production of some secondary product raises questions as to the movements of animals in the prehistoric period. There is no reason to presuppose that the development of sheep with improved fleeces or domesticates with an emphasis on other secondary products is limited only to Classical Athens, or to ancient Greece. The development and interbreeding of livestock varieties need not be limited only to ancient Greece. This textual footnote may provide us with some insights as to reasons for the movement of domesticates and interbreeding between cultures, both in this study and others. The principal, however, remains. If regional varieties of domesticated animals can be shown to exist in one culture - Greece - then they should be investigated in others as well. The potential additional information to the archaeological record - with no destruction of material and little expense - is well worth the inquiry.

If regional varieties were being translocated into different geographical areas, it should be possible not only to identify them, but also to identify their movements into sites throughout the new region, or any interbreeding of animals of these varieties with domesticates of another regional variety. If we are able to identify the movement of regional varieties into other areas, this would presumably imply a level of fairly close contact and interaction between the two groups under study. The degree and nature of such contact would be difficult to distinguish purely from evidence of exchange or interbreeding of livestock, but when taken in conjunction with other lines of evidence should further illuminate intercultural interactions. It is in this way that faunal materials from Greek and non-Greek sites of the study area should provide a unique line of evidence for examining the process and interactions involved in the colonisation of southern Italy and central Dalmatia.

Chapter 6

Site Descriptions and Methodology

If faunal remains are going to contribute meaningfully to the study of complex societies, it is important that they be seen as just one more class of material remains that can provide information about trade, social status, and ethnicity, as well as diet and subsistence. Fauna data cannot be analyzed and interpreted in isolation. [Crabtree 1990:187]

6.1 The Approach

The main goal of this study, as has been stated above, is two-fold. The first hypothesis is that local varieties of domesticated animals can be identified and compared through faunal analysis. It has been argued in the preceding chapter that minor variations in the morphology of domesticate groups can be deduced from a comparison of their biometry. Once we have identified the range and variation in domesticate biometry within Greece we can determine if a variety (or varieties) can be identified. If this hypothesis is correct, the second hypothesis is to determine if this biometric data can be used to identify the movement of Greek domesticate varieties with colonisation in the Archaic through Hellenistic periods in southern Italy and central Dalmatia. This will allow for the identification of areas of Greek settlement in colonies (in theory) provided that Greek livestock varieties were translocated with colonisation and not acquired locally. Any changes or lack thereof in indigenous livestock biometry will provide data on interbreeding or livestock trade, which would indicate contacts or relations between a colony and its setting.

In order to examine this process, faunal data were required for Greece and the colonisation areas under study. It was first necessary to test the first hypothesis - if it was possible to identify 'Greek' livestock. The test of this first hypothesis was to determine if there were Greek livestock which could be biometrically distinguished from indigenous livestock varieties in the areas of colonisation. If livestock in all of the areas considered contained the same biometric patterning (in size and shape), the first hypothesis would be placed in serious doubt. In order to test this hypothesis it was necessary to collect data from several sites of Greece dating from the Archaic to Hellenistic periods. It was also necessary to ensure that a wide geographic area was covered from ancient Greece in order to determine similarity or difference in domesticate varieties of the Archaic to Hellenistic periods. While many site monographs of recent decades contain a discussion of the faunal material, very few were available which contained biometric data. Through correspondence with the analysts, additional data was obtained for the sites of Kastanas and Artemision Olympia. Six sites were eventually selected for comparison as a 'Greek livestock' dataset. The details of these are given in Table 6.1. It would have been preferable to obtain a larger number of sites from Greece, particularly for the Archaic period. However, given time and funding constraints it was not possible to obtain additional site biometric data, either from analysts or from first-hand analysis of data from Greek sites.

In order to fully assess the process and impact of Greek colonisation in the study regions a multilayered approach was required. Greek and non-Greek livestock varieties had to be investigated to see if they could be biometrically distinguished. Following from that, livestock of sites textually identified as colonies were compared with Greek and indigenous sites to determine the livestock variety or varieties present. Indigenous sites in both areas of study were divided into pre- and post-colonisation samples, so that any changes in livestock biometry could be assessed.

For the sites in central Dalmatia analyzed by myself, material was examined from two historically identified Greek colonies as well as two indigenous sites in the area. A third indigenous site (Škrip) was included after biometric data was kindly provided by A. Hammon. These indigenous sites were selected as they were roughly contemporaneous with the nearby colonies but also contained (at Gradina Rat and Škrip) earlier occupation layers which securely pre-dated Greek colonisation in the area. In order to compare the faunal data from these central Dalmatian sites it was felt that an additional example of Greek colonisation would be useful to shed light onto variation or uniformity in the patterning of Greek colonisation and livestock translocation in this area of the Mediterranean. The Greek colonies of Magna Graecia (southern Italy and Sicily) were selected as a comparative case study due to their geographic proximity both to Greece and the sites of central Dalmatia. Thanks to an abundance of published and unpublished faunal biometric data for this area it was possible to collect a large dataset both for colonies and pre-colonisation indigenous settlements. Unfortunately, there was not a large amount of data available for indigenous sites of the Archaic or Classical periods. This was due both to a lack of faunal reports as well as a lack of sufficient biometric data available from the assemblages themselves. An example of this is the site of Morgantina in Sicily. As a site of mixed indigenous/Greek artefacts contemporary with Greek colonies (in much the same way as Incoronata), Morgantina would have been an ideal dataset for examining livestock biometry. The few biometric data recorded by Reese (1993), however, showed only three measureable elements (pig teeth) in the entire domestic assemblage.

6.2 Sample Requirements

In selecting the sites used in this study, several criteria were developed and utilized to gain a comprehensive sample of fauna for the areas and periods under study. An obvious criteria for the selection of sites for this study was that the site in question must contain an adequately collected faunal assemblage. Essentially, it was necessary that the faunal material for the site must have been systematically collected from a secure context. More recent advances (over the last half-century) in excavation techniques and practice have allowed for a greater control over the contextual security of recovered finds. Many sites in the study areas, however, (owing to the long history of research) were excavated at a very early date (generally pre-second world war if not pre-1900) and therefore were often lacking in conserved faunal material altogether.

Once sites containing faunal material were identified the next step was to ensure that they contained assemblages from the desired periods. The growth of influence of the nascent Roman Republic during the later Hellenistic period, particularly for sites in Italy, required that sites be either from the Later Bronze Age and therefore securely prior to Roman influence, or were confidently dated to no later than the fourth century BC. After the fourth century BC Greek cities in this area could have been under the growing Roman influence in the region (Herring 1991:117). For the eastern shore of the Adriatic this Roman influence was also problematic, as historical records place the initial invasion of Dalmatia at 229 BC. For all sites in the study areas it was necessary to ensure that multiple sites were located with (preferably) both pre-Greek and post-Greek occupation sequences, or (failing that) assemblages from only pre-Greek or post-Greek settlement periods. Once sites in these categories were identified it was ensured that the faunal material itself was well preserved,

and contained ample remains on which biometric data could be collected. For the selection of data obtained from published reports this requirement for ample biometric data meant that said reports either contained published biometric data in raw format, or that enquiries to the author provided the additional information. The use here of published data was necessary in order to increase the number of sampled sites beyond what would be otherwise possible within the time frame of research. While some differences in the data may have been introduced by inter-observer variation in measurement, all measures were taken following the standardized criteria laid out by von den Driesch (1976). It should be noted that the number of these measurements which could be obtained from a given site assemblage varies widely between sites, as seen below. The analysis if these data has been constructed with a view towards detailing the problems of the use of small sample sizes of measurements while at the same time maximizing the amount of data which can be obtained from the sites available (see for example Section 7.3.2 and 7.3.4). It should be stated categorically here that the ideal site requirements for this study would include a minimum of thirty to forty sites in the three areas considered, each site having at least a hundred measureable elements for each taxon. In reality, such a study would not only be extremely unlikely it would also be impractical in the time frame of this study.

A factor to consider in any comparison of zooarchaeological data between sites is the type of site being considered. For all site categories (Greek, colony and indigenous) both settlement sites as well as sanctuary/shrine sites are included in this study. Depending on the type and function of a given shrine, the animals killed at the site may demonstrate a highly skewed image of the actual domesticate ratios or biometric varieties seen in the area of the site. This is worth remembering in any comparison of taxonomic proportions. In a perfect world, only taxa from settlement sites would be used. Given the nature of data available for this study, the removal of data from sanctuary sites would leave us with only one Greek settlement (Kassope) and one northern Greek or Macedonian settlement (Kastanas). In the interest of increasing the number of sites where sampling is possible, non-settlement sites have been included here included.

While it is possible that sanctuary sites may contribute their own bias to the data (i.e. through the selection of larger animals through sacrifice) this can be controlled and accounted for by comparing domesticate biometry of both settlement and sanctuary sites for a given culture or region. In this way, the combination of Greek sanctuary and settlement data used for this study benefits rather than

hinders our investigation of Greek livestock. If it is in fact the case that larger animals (or smaller animals, animals of only one sex or those of a different variety from settlement livestock) were preferentially selected for sacrifice at sanctuary sites, this would be expressed through variation between the biometry of animals recovered from settlement and sanctuary sites. As will be seen below in the descriptions of the individual site assemblages, there is no indication from the Greek sanctuary sites for a preference towards male animals (which from sexual dimorphism would be larger). It should be remembered that few bones from domesticated animals can be reliably sexed, so a preference for male or female animals is difficult to accurately determine.

For this study, both the range of biometric variation (across the entire body of biometric data for a given site) and the mean biometric values for that site will be taken together to indicate the presence of absence of a variety of livestock for Greece, southern Italy, central Dalmatia and Greek colonies in these regions. In order for a variety to be identified it must necessarily correspond in both its mean and variation (or range across all three shape proportions) between the sampled sites of Greece as distinct from those indigenous sites of southern Italy and central Dalmatia. It may well be the case that Greece from the Archiac to Hellenistic periods contained many varieties of domesticated livestock, either co-existing across several regions or separately within each region. These varieties may have been distinguishable by temperament, wool quality, coat colour or any number of distinguishing criteria apart from size and shape. However, as the data in this study is comprised only of the osseus remains of these once-living animals, we are restricted in our inquiry into investigating possible variations in size and shape between the remains of these animals.

6.3 **Recording Techniques and Criteria**

6.3.1 Identification

Material analysed for this study was sorted initially into identifiable and unidentifiable remains following a system adapted from that of Miracle (Miracle and Pugsley 2006:260). Identifiable remains were selected as meeting at least one of the following criteria: complete bones, bones with intact articular surfaces, long bone shafts of recognizable shape or bearing diagnostic muscle at-tachments/nutrient foramina, loose epiphyses or metaphyseal margins of long bones, worked bone, loose teeth or tooth fragments bearing identifiable cusps, any bone which could be readily identified

and fragments of horn core or antler. Unidentifiable bones were divided into burned or unburned fragment categories and each further subdivided into shaft fragments, cranial fragments, rib fragments, cancellous bone or 'other' (those small fragments not readily recognizable as belonging to one of the aforementioned categories). The fragments were then counted and weighed and recorded separately.

Identifiable material was analysed with the aid of the comparative collection at the Grahame Clarke Laboratory of the Department of Archaeology, University of Cambridge. Due to limitations on what material (in weight and volume) could be taken back for further analysis, fragments and readily identifiable material (intact elements, easily identified long bone portions, some teeth) were identified, recorded and measured on site at the Muzej Grada Kaštela in Kaštela, Croatia. Any element not identifiable with 100% certainty was brought back to the University of Cambridge for further analysis. Taxonomic identification was assisted with the available extensive reference collection as well as numerous publications (Hillson 12005; Schmid 1972; Prummel 1987a; Prummel 1987b; Zeder and Lapham 2010; Zeder and Pilaar 2009). Identification challenges included differentiation of sheep (*Ovis*) and goat (*Capra*) and the differentiation of various foetal and infant remains. Despite literary resources and reference specimens some elements could not be differentiated between *Ovis* and *Capra*. These were classified following the standard form as *OvisCapra*.

All identifiable remains were recorded using the coding system adapted from Miracle (Miracle and Pugsley 2006:260; Table A.13). This was chosen as it allowed for detailed descriptions and measurements with a large amount of inherent flexibility in the system for both routine recording as well as the addition of new categories and taxa. This system records data by context on species, element, portion and completeness, side, age and criteria for ageing, sex, breakage, weathering, burning, type and location of burning, human modification, weight, gross size, working (cutmarks, etc.) and measures. Measurements were taken following the criteria detailed by Von Den Driesch (1976). In keeping with these specifications and to ensure standardization in biometric data only adult (fused) elements of excellent preservation and lacking in pathologies were measured. The data was input for this system using Microsoft Excel. Data from the survey of published material were compiled using Microsoft Excel in a separate file. Details of taxonomic and element representation, age profiles, butchery patterns (cutmarks and breakage), weathering and biometric data were compiled for each site (where possible). Biometric data was analysed using SPSS (Sta-

tistical Package for Social Scientists). Sites lacking in 'excellent' osseous preservation were not included with the exception of Kabirenheiligtum bei Theben (Boessneck 1973), as preservation at this site was fair but the bones were described as slightly 'crumbly' (*bröcklig*). Only those elements with sufficiently good preservation (specifically of articular surface margins) for measurement were measured, and the judgement of Boessneck is (for better or worse) being relied upon to ensure that the measures given are accurate with regards to the bone prior to taphonomic leaching.

6.3.2 Quantification

While the subject of quantification in zooarchaeology has received a great deal more debate in and out of print than could be conceived possible for any given subject, the techniques of quantification used here are fairly standard. NISP, or Number of Identified Specimens is the total number of fragments which could be identifiable to genus (or at least size class) for a given assemblage. This technique is of high utility in this study as it allows for a comparison of taxonomic representation between occupation periods of a site as well as between different sites in a given period. The drawback to quantifications given in NISP is that they are susceptible to inflation through increased fragmentation of remains. This inflation can be controlled for somewhat by the additional calculation of Minimum Number of Individuals (MNI) for an assemblage (Lyman 2008:43). While NISP is essentially calculated by adding up the number of remains identified to taxon, MNI is calculated by counting the number of non-repeating elements for each taxon (such as right distal tibiae) and then adjusting for age categories. For this, the presence of both (for example) infant and adult bones of the same taxon in an assemblage is considered to have an MNI of two even if there is no more than one of each element (from a given side). This is because it is impossible for a single individual to exhibit the skeleton of both an infant and an adult, and so the remains must come from a minimum of two individuals. This technique is not without its own faults; for example, MNI must be calculated for an entire site, or an entire secure, contiguous layer in order to avoid inflation from aggregation (Crabtree 1990:159). An example of this inflation of MNI would be a single sheep carcass divided amongst the members of six houses (or pits, etc.) at a site. A separate MNI calculated for each house would give an MNI of six sheep (one per house), as opposed to the more accurate MNI of one calculated across that layer at the entire site. MNI is used here in conjunction with NISP counts in order to create a simple control for fragmentation (high NISP and low MNI suggesting a greater degree of fragmentation in the assemblage than a low NISP and high MNI).

6.3.3 Age Profiles

Age at death estimates were collected, where available, for all sites in the study. In order to determine the culling profiles for each site and taxa, proportions of fused and unfused bones were calculated for each age group. Additionally, age data could be obtained from the presence or absence of unification of portions of different elements (such as the union of ischium, illium and pubis to form the innominate or the union of metapodial halves). The stage of unification of a bone or fusion of the epiphyses was used to determine the approximate age for the animal which contributed each element studied. These age ranges were obtained from previously studied rates of union and fusion for each element for each taxon (Deniz and Payne 1982; Greenfield and Arnold 2008; Grigson 1982; Silver 1969; Zeder 2006;). The advantage of data on culling profiles for these sites is that they allow for a comparison of domesticate herd management strategies. Age profiles for epiphyseal fusion were calculated from the number of fused and unfused complete elements or articular ends. For each age group (fusion group) the percentage of unfused elements was subtracted from the total number of elements in a running total. For example, a sample containing a hundred fused and unfused elements (100% of elements) which contained ten unfused proximal radii (fusing at around two months in sheep) would therefore reduce to 90% at 2 months. A further ten pelves with unfused acetabuli would reduce the survivorship total to 80% at six months, and so on.

Dental attrition (tooth wear) was not evaluated for this study as rate of tooth wear within a given taxa are dependent on not only the age of the animal but also local diet and population variation (Steele 2006:126). It is thus less precise when comparing animals between sites of different areas. This technique was also disregarded as a large proportion of teeth in the study for sites were loose and therefore could not be scored relative to one another, or tooth wear data were not given in published or unpublished reports. Culling profiles were calculated on the basis of raw reported (where available) and self-collected data and were converted for each site and taxa into kill-off profiles based on standard fusion intervals (Figure 7.2).

6.3.4 Biometric Data

Biometric data for each site and taxa were taken according to the criteria set out by von den Driesch (1976). Biometric data, once collected, were assembled in a spreadsheet by taxon using Microsoft Excel. A critical evaluation of body size and element proportions allowed for a distinction between Greek and indigenous varieties of livestock in the areas under study. A collection of biometric data from sites across Greece was compiled and compared to sites from both the eastern and western Ionian/Adriatic regions. As raw measures were not plentiful enough for any given element for direct comparisons of element proportions to be made between all sites in the study area, a log index ratio comparison was made for domesticates. This ratio was calculated as LSI(Log Standard Index) following the equation LSI = loq(measure) - loq(standardmeasure). For ease of display in the graphs seen in Chapters 7 and 8, the resulting LSI values were also multiplied by 100, following the calculation described by Meadow (1999:290). Standard measures used were taken from a wild collected mouflon (Ovis orientalis) skeleton, a laboratory specimen of wild boar (Sus scrofa) and a complete museum specimen of an aurochs (Bos primigenius). These standard measures and the origin of each skeleton are given in Tables C.1 through C.3. Because bones are more plastic in nature than teeth, biometric comparisons between study groups were made for both bones and teeth (where available) as separate sets of data. The two groups were analysed separately. Details and findings of these analyses are given in Chapters 7 and 8. Biometric data collected were analysed using Statistical Package for Social Scientists (SPSS).

In order to determine similarities or differences between the domesticate populations of each site in the study, LSI data from both individual sites and site categories (Greek sites, Italian colonies, etc.) were subjected to the Mann-Whitney U test. This assessment tests the differences in the dispersions of the two populations. This test was used on LSI data and also on comparisons of 'raw' measures for the most common elements¹. The formula for this test is:

$$U = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - R_1$$

¹As some measures, such as the proximal humerus, were only available from one, two or no elements from a given site these calculations were deemed irrelevant. Thus, calculations were taken only for elements numerous at most or all sites, such as those of the distal tibia.

6.4 The Sites

6.4.1 Sites of Greece



Figure 6.1: Map showing the locations of sites of Greece which were used for this study. The chronology and faunal analyst of these sites are given in Table 6.1

	Site	Location	Archaic	Classical	Hellenistic	Analysis by
1	Kassope	Greece			Х	Friedl 1984
2	Kabirenheiligtum bei Theben	Greece		Х	Х	Boessneck 1973
3	Artemision Olympia	Greece	Х			Benecke 2006
4	Poseidon a Tenos	Greece			Х	Leguillox 1999
5	Herakleion de Thasos	Greece	Х	Х		Pariente et al. 1996
6	Kastanas	Greece	Х	Х	Х	Becker 1986

Table 6.1: List of Greek site assemblages used in this study. The chronological periods of occupation are listed, although those sites with Roman period occupation levels did not have these layers included in the study sample. The analyst and author from which metrical data were obtained are given.

Kassope

The settlement of Kassope is located near the Ionic coast of Epirus and dates to the Hellenistic period, primarily to the fourth century BC. The site was excavated from 1977 to 1981 by the German Archaeological Institute of Berlin under the direction of Dr. W. Hoepfner and Dr. E.L. Schwander in conjunction with scientists of the Greek University of Joannina. The faunal material recovered from these excavations were sent to the Institute for Palaeoanatomy, Domestication Research and History of Animal Medicine at the University of Munich. Here they were analyzed and published by Friedl (1984) under the direction of Boessneck (1994). A total of 28,462 remains were identified for the more common mammals, of which 234 were measured for the taxa considered in this study.

Kabiren bei Theben

The Kabirenheiligtum bei Theben, or the Kabirion sanctuary near Thebes was excavated in 1956, 1959 and the 1960s by a team under the direction of Prof. F.G. Bruns of the German Archaeological Institute at Greece. The faunal material from this excavation was sent to the Institute for Paleoanatomy, Domestication Research and History of Animal Medicine (University of Munich) for analysis in relation to their sacrifice ceremony/sanctuary context. The analysis was carried out by Boessneck and published in 1973. The site contained excavated material from the Classical to Roman periods. The analysis by Boessneck focused on the high frequency of astragali, the dominance of domesticated as opposed to wild animals (and of sheep and goat within the domesticated animals) and on the increased size of sheep and cattle (based on Widerristhöhe) at this site vis a vis those of the Bronze Age site of Argissa-Magula in Thessaly (Boessneck 1973:11). Publication of the material discriminated between those remains from the Classical, Hellenistic and Roman periods, allowing for the use here only of the measures from the Classical and Hellenistic periods. A total of 4,043 remains were identified from this sanctuary, the overwhelming majority of which (3,828) came from domesticated animals. Of these, 83 were measured from the Classical and Hellenistic periods (for the taxa considered in this study). No details are given as to the recovery of this material, but it is assumed given the date of excavation that this site was hand collected.

Artemision Olympia

The area around the altar of Artemis at the site of Olympia was excavated in 2002 by a team from the German Archaeological Institute of Berlin, headed by Dr. Joachim Heiden. In an effort to better understand animal sacrifice at Late Archaic period Olympia, the faunal assemblage from the undisturbed altar deposits was analyzed and published by Benecke (2006). A total of 1,380 specimens were analysed for taxonomic identification (of which 756 were identifiable), cutmarks and burning, as well as age classifications of identified elements where possible (Benecke 2006: 154). These were compared with faunal remains from sacrificial contexts at other Greek sites on the basis of element representation, taxonomic variation and burning of bones. From the distribution of butchery marks Benecke (2006:154) was able to demonstrate that the recovered faunal material was representative of food/sacrificial waste and was 'overwhelmingly' comprised of domesticated animals and hares (*Lepus europaeus*).

The domesticated assemblage was dominated by sheep (*Ovis aries*), mainly over two years of age at the time of slaughter. The next most common domesticate was cattle (*Bos taurus*) which were killed at a range of ages. In both cases, all elements were recovered with the notable exception of femur bones from both taxa, and a reduced proportion of caudal vertebrae. This is postulated to relate to the removal of the thighs and chine during the sacrifice process. This was compared to data from the sanctuaries of Artemision of Ephesos, Eretria in Euboea, Apollo at Halieis and Heraion on Samos, which provided similar evidence for a dominance of sheep (at Ephesos) and the removal of thighs and chine during sacrifice (Benecke 2006:156). A comparison of those few bones which could be sexed demonstrated one ram, two ewes and three wethers (castrated rams) for sheep, and a single cow for cattle (Benecke 2006:156). Biometric data were not included in the published report, but was kindly provided by Dr. Benecke upon request. The fragmentary nature of the assemblage did not produce a large number of measurable elements. In all thirty-eight elements could be measured. Of these two came from *Bos taurus* (both teeth), three from *Capra hircus*, and the remaining thirty-three from *Ovis aries*.

Poseidon a Tenos

The Sanctuary of Poseidon and Amphitrite on the island of Tenos dates from the fourth to second centuries BC, or to the Hellenistic period of Greece. The material used in this study was excavated
in the 1970s by Roland Etienne and comes from an area of street bordering the stoa, and also from the sanctuary's kitchens. The analysis and publication carried out by Leguilloux (1999) focused primarily on the evidence for sacrifice at this sanctuary. Particular attention was paid to the proportions of different taxa and the ages chosen for sacrifice, as well as butchery evidence on the recovered remains. These were then compared to data from other sanctuaries of Greece as well as historical references to sacrifices by deity. The most frequently recovered taxon was cattle (*Bos taurus*), as opposed to sheep in other comparison Poseidon sanctuaries, a preference for young pigs and sanctuaries to Demeter, birds to Aphrodite, dogs and sheep to Athena and very young ruminants (sheep and goats) to Apollo (Leguilloux 1999:429-32). At this site the majority of sheep and cattle were sacrificed as adults, and pigs between 12 and 24 months (Leguilloux 1999:434). A total of 278 remains were identified by Leguilloux, of which 35 were be measured.

Herakleion de Thasos

The sanctuary of Herakleion on the island of Thasos was originally excavated in the mid-1900s by Launey. The sanctuary is interpreted as related to the cult of Heracles on the basis of inscriptions recovered in the agora (Pariente, Des Courtils and Gardeisen 1996:799). The site dates from the later sixth to the fourth centuries BC, or roughly to the Classical period. Faunal material from this site was analyzed and published by Pariente, Des Courtils and Gardeisen (1996), who focused mainly on evidence of butchery and sacrifice at the site. This study focused on the preference at the site for sheep across all chronological periods, as well as examining the representation of elements, including the low representation of femora relative to other elements. Contrary to the data from Artemision Olympia, however, the caudal bones (chine) were one of the more commonly found element categories for both sheep/goat and cattle (Pariente, Des Courtils and Gardeisen 1996:807). A total of 555 remains were identified from the sanctuary of which 37 were measured. All measured bones reported by Pariente, Des Courtils and Gardeisen (1996) came from *Ovis aries*, which was by far the dominant species present (c.60-80% by context).

Kastanas

The site of Kastanas is located in northern Greece, in the (modern day) Greek portion of what was ancient Macedonia. It lies on the banks of the Axios river two kilometres west of the modern

village of Kastanas from which it derives its name. It is located approximately forty kilometres from Thessaloniki on a wide flood plain (4-5 kilometres in breadth and nearly 40 kilometres in length). The site was excavated from 1975 to 1979 under the direction of Prof. B. Hänsel (Becker 1986:13). The occupation sequence of the settlement runs from the Early Bronze Age (c. 2400 BC) to the Late Iron Age (c. 200 BC). Faunal material was analyzed and published by Becker (1986). A total of 69,868 elements from mammals were identified. For this study only layers one (c. 200 BC) to eight (c. 800 BC) are considered (Becker 1986:16). It should be noted that layer two dates to c. 600 BC, so the vast majority of this sample comes from a period corresponding roughly to the Archaic period of Greece (Becker 1986:16). Given the location of this site within what was at the time Macedonia and not Greece, the domesticates from this site are not strictly assumed to be of the same variety of those from the other 'Greek' sites included in this study. However, given the corresponding chronological representation and settlement of Greeks on the Chalkidiki peninsula and other nearby regions in the periods covered by this sample, it was included as a semi-outlier to the Greek dataset. Biometric data was not fully published for this site, but was kindly given by Dr. Becker upon request. A total of 6225 (most common) mammal remains were identified from layers one to eight, of which 721 were measured for the taxa considered in this study.

	Site	Location	LBA	IA	Archaic	Classical	Hellenistic	Analysis by
1	Torre Mordillo	S. Italy	X					Tagliacozzo & Curci
								2001
2	Termitito	S. Italy	X					Bökönyi 2010
3	Coppa Nevigata	S. Italy	X					Siracusano 1993
4	Incoronata	S. Italy		X	Х			Bökönyi 2010
5	Monte Irsi	S. Italy		X			Х	Barker 1977
6	Roccagloriosa	S. Italy					Х	Bökönyi 1993
7	Pomarico Vecchioi	S. Italy					Х	Aimar 1997
8	Eraclea Lucana	S. Italy			Х	Х	Х	Wilkens et al 2002
9	Lentini	Sicily			Х			Wilkens 2008
10	Locri Epizephiri	S. Italy			Х			D'Errico & Moigne
								1985
11	Kaulonia	S Italy			X	Х		Columeau 1989
12	Pantanello	S. Italy				X	Х	Bökönyi 2010

6.4.2 Colony Sites of Southern Italy and Sicily

Table 6.2: List of sites from southern Italy and Sicily with assemblages which have been used in this study. The chronological periods of occupation are listed, although those sites with Roman period occupation levels did not have these layers included in the study sample. The analyst and author from which metrical data were obtained are given.



Figure 6.2: Map displaying the locations of sites of southern Italy and Sicily containing assemblages used in this study. The chronology and faunal analyst of these sites are given in Table 6.2

Eraclea Lucana

The site of Eraclea Lucana (or Heraclea in Lucania) is located along the Ionian coast of Calbria in southern Italy. According to historical sources (Diodorus the Sicilian) it was founded 550-432 BC by Athenian colonists on the site of the Ionic colony of Siris (which was itself supposedly founded by the Trojans) (Forsythe 2005:34). Material studied here dates roughly from the seventh to fourth centuries BC, was excavated between 1986 and 1993 and was analyzed and published by Wilkens *et al* (2002). This analysis focused on taxonomic ratios and element representation as well as heavily upon evidence of butchery in an examination of the sacrifice rituals conducted at the site. A total of 4,521 remains were identified, of which 249 were measured.

Lentini

Material from Lentini comes from a shrine in the sanctuary of Alaimo, located on the western edge (a little over a mile from the perimeter) of the Greek colony of Lentini in Sicily. The colony of Lentini, according to historic sources, was founded 729 BC by the colony of Naxos in Sicily (itself founded 734 BC by Chalcis) (Forsythe 2005:34). The sanctuary was excavated in the winter and autumn of 1988 in collaboration between the Superintendence of Cultural and Environmental Heritage of Syracuse and the University of Catania (Grasso 2008:21). The material used in this study comes from the mid-seventh to early sixth century BC (Wilkens 2008:169). The published analysis by Wilkens (2008) focused primarily on the taxonomic abundance, age classes and butchery evidence of sacrifice at this site. These were compared with sacrifice evidence from other Greek religious sites, including the altar of Aphrodite Urania in Athens (*c*.500 BC) and Eretria, as well as that of Eraclea Lucana (Wilkens 2008:174). A total of 952 elements were identified, of which 119 were measured.

Locri Epizephiri

The site of Locri Epizephiri is located along the Ionian coastline of Calabria in southern Italy, roughly three kilometres outside the modern city of Locri. According to ancient textual sources, the Greek colony of Locri Epizephiri was founded between 679-673 BC by colonists from Locris (Forsythe 2005:34). Excavation at this site began in 1890, altough early research focused primarily on the necropolis, temple and theatre of the settlement. The material used in this study came from excavations of the 1950s by the Institute of Archaeology of the University of Turin. Although the site excavation areas indicated continuous settlement from the seventh to second century BC, the faunal material considered here (from the four houses near Street 53 in the western area of excavation) comes from the sixth century onwards. This material was analyzed and published by D'Errico and Moigne (1985), who focused on the taxonomic distribution and evidence of butchery. A total of 374 elements were identified, of which 22 were measured.

Kaulonia

The site of Kaulonia lies on the Ionic coast of Calabria. It is recorded in textual sources as having been founded at the end of the eighth century BC by Achaean colonists (Pausanias 6,3.12). During

the later sixth and much of the fifth centuries the city appears to have prospered, as evidenced by its minted silver coins (Treziny 1989:10). It was destroyed, according to textual sources, by Dionysius the Elder in 389BC. Material for this study comes from excavations of the northern area of fortification which were undertaken between 1982 and 1985 covering all phases from the Archaic to earlier Hellenistic periods. The faunal material was analyzed and published by Columeau (1989). Material of the faunal assemblage also comes from the Archaic to Hellenistic periods, although in the case of the 'Hellenistic' fauna this is identified as being post 389BC.² With regard to the biometry of animals from this site, the cattle are discussed as being 'small', aside from a single 'large' astragalus. Aside from this and the publication of measurements the paper focuses on a comparison of taxonomic distributions between this site and others in the region (i.e. Locri Epizephiri, Monte Irsi). As biometric data published from this assemblage was identified by period, it was possible for this site to use measurements only from the Archaic and Classical periods. A total of 547 remains were identified from these periods, of which 40 were measured.

Sanctuary at Pantanello

The Pantanello Sanctuary dates from the sixth to third centuries BC. The site was excavated along with two other rural sanctuaries in the area of Metaponto by the Institute of Classical Archaeology of the University of Texas from 1974 to 1993. This site is located roughly 3kilometres southwest of the city walls of the colony of Metaponto, or Metapontum as it was in Greek times (Coleman Carter 2005:5). Metapontum, according to historical sources, was founded 650-600 BC by colonists from Achaea (Forsythe 2005:34). The sanctuary is located around a spring and was exceptionally well protected and preserved, being buried under *circa* two meters of humid clay (Colement Carter 2006:7). This sanctuary, coupled with the nearby indigenous site of Incoronata (eighth to sixth centuries BC) as well as the Late Bronze Age site of Termitito allow for an examination of domesticate varieties in all three site categories (pre-colonial indigenous, colonial indigenous and colony) from not only southern Italy but from an extremely narrow geographical area. It is for this reason that the sanctuary was included in this study, despite the fact that its chronology, continuing up to the third century BC, is one century too young for the previously aforementioned cut-off line. While all sites were selected with a view towards a narrow geographical distribution of sites (so

²Data from the Hellenistic period fauna were not included in this study as they were mostly from too late a date for clear seperation from Republican Rome.

much as was possible) these three sites provide the ideal geographical distribution by which to examine domesticate varieties and their change though time. A total of 1,186 identifiable bones were analyzed by Bökönyi (2010) of which 71 were measured for the taxa considered in this study.

6.4.3 Indigenous Sites of Southern Italy and Sicily

Torre Mordillo

The indigenous site of Torre Mordillo is located on the western coast of southern Italy, on the Ionian coastline of northern Calabria. It is roughly one kilometre from the confluence of the Esaro and Coscile rivers and occupies a plateau commanding a view across the plain of Sybaris to the sea coast. The site was occupied from the Middle Bronze Age until the Iron Age (eighth century BC). Excavations of the settlement were conducted from 1987-1990, the results of which were published by Trucco and Vagnetti (2001). Aegean-type ceramic sherds were recovered from this site, a sample of which (c.40) were subjected to chemical analysis by Jones (2001) using atomic absorbtion spectromony. As with the majority of Aegean-type sherds from nearby Broglio di Trebisacce, the majority of Aegean-type sherds from Torre Mordillo appear to be imitations of local manufacture (Jones 2001:334). The analysis and publication of faunal material by Tagliacozzo and Curci (2001) considered material from the Middle and Later Bronze Ages. Material used in this study comes from the Late and Final Bronze Age portions of this assemblage. A total of 1085 remains were identified from this period, of which 208 could be measured. Of these measured elements, only 171 related to taxa used in this study.

Termitito

The site of Termitito is located roughly 7kilometres from the Ionic coast of the Salento peninsula, on the plain of Metaponto next to the Cavone river. It is situated on a hill some two hundred meters above sea level commanding a view of the area extending to that of the entire Salento peninsula on a clear day (Bianco 1982:69). The site was excavated from 1973 into the 1980s and evidenced several finds of Mycenaean (LHIIIB and LHIIIC) and Protogeometric ceramics. The site dates to the Later Bronze Age, or roughly the *Bronzo Recente* and the transition to the *Bronzo Finale* in the (somewhat debated) local chronology (Bianco 1982:75). Faunal material from this Late Bronze Age occupation was analyzed and published by Bökönyi (2010). A total of 692 remains were

identified, of whch 25 were measured for the taxa considered in this study.

Coppa Nevigata

The stratified settlement of Coppa Nevigata is located along the Adriatic coast close to the delta of the Candelaro river, in the Foggia area of southern Italy. During the Bronze Age, Coppa Nevigata was the northernmost site for Aegean maritime trading expeditions and played an increasingly important role in both inland and maritime trade (Siracusano 2006:41). Excavations began in 1950, although the main series of excavations were conducted from 1967 to 1975 by the Institute of Paleontology at the University of Rome, which uncovered deposits dating back as early as the seventh millenium BC (Cassano 1987:45). The main area of excavation halted in 1971 when an 'act of vandalism by a bulldozer' took away eighty centimetres of surface, including the stone structures uncovered during the excavation (Siracusano 1993:185). Excavations were resumed in 1983 by A. Cazzella and M. Moscoloni in an undamaged area a few tens of meters away from the previous excavation. Faunal material from these Later Bronze Age occupations of the site was analyzed and published by Siracusano (1993; 2006). A total of 14,680 remains were identified, of which some 156 were measured for those taxa considered in this study.

Monte Irsi

The site of Monte Irsi lies on a comparatively isolated hill rising about 200m above the junction of the Bradano and Basentello rivers in the Basilicata region of Puglia (Buck 1977:4). The site was excavated 1971-1972 by A. Small. Several occupation phases were uncovered. Phases I and II date to the Iron Age, tentatively dated by the ceramics to around the last quarter of the eighth to first half of the seventh centuries BC (Small 1977:14). Three geometric sherds were also recovered from phase I, although their status as imports or local imitations is unknown. Phase III dates from c.725-600 BC and phases IV and V to c.400 BC. Faunal material recovered from these excavations was analyzed by Barker (1977). A total of 304 elements were identified from this assemblage, of which 31 measurements were reported. Unfortunately, the small sample of measures for this site was not given with reference to the phase of occupation for each measured element. Consequently, the measures are a mix of both the earlier (Iron Age) and later (Hellenistic period) phases of this site, or an averaged span of occupation throughout the Greek colonisation period in this area of

southern Italy. Each phase also seems to have made a similar proportional contribution to the number of identified remains for this site, so it is difficult to determine whether this material is to be considered Iron Age/Archaic (like Incoronata) or Hellenistic (like Roccagloriosa and Pomarico Vecchio) in character.

Incoronata

The Iron Age site of Incoronata is an indigenous village in the chora of Metaponto. It is located on the plateau of a hill along the south side of the Basento river. The site was occupied from at least the ninth century BC to the later seventh/sixth centuries BC (De Siena 1990:83). Excavations were carried out more-or-less simultaneously with those of Pantanello and the remainder of the Metaponto chora (1980s) and continue up to the present day. Incoronata was believed from earlier interpretations to have been an indigenous settlement which was removed and replaced by an Ionian Greek emporion which was then replaced by Achaean Greek settlers from Sybaris who founded a colony there. This traditional interpretation was hotly contested by more recent 1980s excavations and interpretations by De Siena (1990:88) who argues for cultural continuity at this site from the Bronze Age throughout the period of Incoronata "greca" down through the late seventh century BC and the establishment of Metaponto. The site is therefore of a somewhat contested interpretation, with the current prevailing theory seeing it as an indigenous village with some Greek contact and imported elements of material culture right up until it disappeared as a settlement (Coleman Carter 2006:6). Faunal material from this site (from the earlier years of excavation) dating from the eighth to sixth centuries BC was analyzed by Bökönyi (2010). A total of 304 identified remains were analyzed, of which 71 were measured for taxa considered in this study.

Pomarico Vecchio

The site of Pomarico Vecchio is located twenty-three kilometres from the colony of Metaponto, along the banks of the Basento River (Barra Bagnasco 1997:1). The site was excavated from 1982 to 1986 under the direction of De Siena in collaboration with the Soprintendenza Archeologica della Bascilicata and dates to the fourth century BC (Barra Bagnasco 1997:4). Faunal material from these excavations was analyzed by Aimar (1997). A total of 2620 remains were recovered from the site, of which some 758 elements could be identified. From these identifiable remains a

total of 33 were measured (Aimar 1997:275).

Roccagloriosa

The site of Roccagloriosa is located along the western side of the Capitenali ridge along the Gulf of Policastro. The initial survey of the site was conducted in 1971 by M. Napoli, who suggested that the growth of this 'centre' over the Iron Age was related to the interests in the fifth century BC of Greek colonies along the mid-Tyrrhenian coast (Gaultieri 1993:9). Excavations of 1976-77 and 1978 by M. Gaultieri on behalf of the Archaeological Superintendency of Salerno. The site was deemed to be culturally Lucanian, and the ceramic chronology was limited almost exclusively to the fourth century BC. Excavations continued from 1982-88 (Gaultieri 1993:10). The faunal material recovered from these excavations were analyzed by Bökönyi (1993). A total of 1,799 were identified, from which 46 measures were reported for the taxa considered for this study.

6.4.4 Colony and Indigenous Sites of Dalmatia



Figure 6.3: Map showing the location of sites from central Dalmatia which were used in this study. The chronology and faunal analyst of these sites are given in Table 6.3

	Site	Location	LBA	Iron Age	Archaic	Classical	Hellenistic	Analysis by
1	Resnik	Dalmatia					Х	Sanford 2011
2	Spila Nakovana	Dalmatia					Х	Sanford unpub-
								lished
3	Pharos	Dalmatia					Х	Hammon unpub-
								lished, Sanford
								unpublished
4	Gradina Rat	Dalmatia	X	Х				Sanford and Bar-
								barić, in prep
5	Škrip	Dalmatia	X					Hammon unpub-
								lished

Table 6.3: Dalmatian sites analysed for this study. All sites in this table were analyzed in whole or in part by myself, with the exception of the site of Škrip. The chronological periods of occupation are listed, along with the analyst and author from which metrical data were obtained from those remains not analyzed by myself.

Resnik

The settlement of Resnik is located on the shores of Kaštel Bay in central Dalmatia. It is believed on the basis of textual and artefactual evidence to be the site of the ancient city of Sikuli (Šuta 2011:22).

Occupation layers date from the later fourth/earlier third century BC to the second century BC. Material analyzed for this study came from the earlier occupation layers of the third century from several house and street contexts of the city. It is possible, although not historically certain, that this settlement was one of several colonies founded by the Greek colony of Issa along the shores of central Dalmatia. Both the architecture and artefactual evidence points to this settlement as a Greek colony; from its date and location as well as textual sources it has been interpreted as such. Material was recovered by hand sorting from excavations of 2004 to 2010 carried out by the Muzej Grada Kaštela (Kamenjarin and Šuta 2011:12). A total of 2,548 remains were identified and analysed by myself, of which 44 were measured (Sanford 2011:153).

Spila Nakovana

Spila Nakovana, or Nakovana cave, is a cave site on the Pelješac peninsula of central Dalmatia. Sporadic occupation evidence dates from at least the Neolithic through to the later Hellenistic Period. Excavations of 1999 and 2000 by teams from the Zagreb Institute for Anthropological Research and the Archaeological Museum of Split uncovered dense quantities of Hellenistic period (fourth to third centuries BC) Greek finewares as well as evidence of occupation or at least human visits to this cave (Forenbaher and Kaiser 2003: 20). A side chamber containing a centrally placed phallic stalagmite was also found, which contained the greatest densities of Hellenistic Greek finewares. Material from this site was wet sieved over fine mesh to ensure maximum recovery. Material from the Later Bronze Age layers of the site were analyzed by Dr. Preston Miracle, but did not contain measurable remains (P. Miracle, personal communication). Material from the Hellenistic period was analyzed for this study. A total of 548 identifiable remains were analyzed by myself, of which 53 were measured.

Pharos

The settlement of Pharos is located at the western end of the island of Hvar off the coast of central Dalmatia. According to historical sources the settlement was founded in 384/3 BC by colonists from the Greek island of Paros. This colonisation was supported and assisted by the tyrant Dionysus I of Syracuse in Sicily, who at the same time assisted in the foundation of the Syracusean colony of Issa on the nearby island of Vis (Kirigin 2006:43). The majority of the ancient settlement is now

located under the modern city of Stari Grad. Material used in this study was hand collected from trenches excavated 1993 to 2009. These trenches contained material which could be divided into three occupation phases. These phases dated to the early fourth to mid third century BC (Greek colonial period), the mid third to second century BC (Hellenistic period) and the first century BC to second century AD (Roman period). Only material from the first two occupation phases was analyzed for the present study. This material is a combination of that analyzed and measured by Hammon (unpublished) and myself. These combined assemblages contained 116 identifiable remains, of which 22 were measured.

Gradina Rat

The settlement of Rat is located in the northwest of the island of Brač, off the coast of central Dalmatia. It is located in an area almost equidistant from the sites of Pharos and Resnik and close as well to the site of Škrip (roughly seven kilometers as the crow flies). Material used in this study comes from excavation trenches made during the 2007 and 2010 campaigns. These trenches contained well stratified deposits dating from the Bronze to Iron Ages, although only material from the Later Bronze and Iron Ages (layers one through nine) was used for this study. These layers date from the Middle Bronze to Iron Ages, or 1300 BC (Greek and Italian Later Bronze Ages) to the Hellenistic period (Barbarić, personal communication). Excavated material was sieved through a 5 mm mesh, greatly increasing the overall recovery of faunal material (particularly bird, fish and juvenile mammal remains). A total of 951 identifiable remains were analyzed by myself, including 119 which were measured.

Škrip

The Late Bronze Age hillfort of Škrip is located in the western area of the island of Brač. It is approximately seven kilometres from the site of Gradina Rat and eleven kilometres from the modern town of Bol. Early interpretations of the site considered it to be a Greek colony, or built by Phoenicians in the seventh century BC (Beaumont 1936:172; Skok 1950:172). Later considerations argued that it was an indigenous Iron Age settlement with walls constructed under Greek influence (Rendić Miočević 1954:92). Excavation in 1970 of ten trenches at the site led to its interpretation as a prehistoric (Later Bronze Age) indigenous site with indigenous-built defensive walls (Faber

1975:97). Three trenches were laid into the site in 1995 to identify stratigraphic relationships between its phases of occupation (Bronze Age to Roman) (Stančič *et al* 1999:17). Material from this trench produced faunal material relating to three phases of occupation: Earlier Bronze Age, Later Bronze Age and Later Bronze Age/Early Iron Age. In total 164 identifiable elements were recovered from this earlier excavation, of which 30 could be measured. From this material, 140 identifiable elements (of which 18 were measured) related to the Later Bronze and Early Iron Ages and were used for this study.

Chapter 7

Size Matters: The Quest for 'Greek' Taxa

But although sheep had been kept for several thousand years, it is remarkable that most of the major changes, e.g. horn variation, the lengthening of the tail ... and the development of a white, woolly fleece had taken place by the time that illustrations and records first appear.... The breeding achievemnets of early man become less amazing when we realize that he lived closer to his animals than we care to contemplate, and this enabled him to observe simple rules such as 'like begets like' long before the writings of Roman animal breeders. The keeping of particularly desirable animals would have constituted the first (unconscious) selective breeding. [Ryder 1982:17]

Considering the previous arguments that current archaeological theory is unable to agree on specifically what it meant to be Greek (particularly in the Archaic period) and that there is no consensus as to the nature and process of Greek colonisation (or even if it should be termed 'colonisation') it is important that every available avenue is taken to increase the current state of understanding of both the Greek world at the time of colonisation and the settlement and provisioning of the colonies themselves. It is for this reason that the investigation of domesticated animals in Greece (as well as those of indigenous groups in the areas of colonisation) is of great utility in examining the arguments of both Greek cultural (or perhaps 'hellenic') development and interaction as discussed in Chapter 3, as well as the scale and nature of contact between Greece and the Adriatic/Ionian regions as discussed in Chapter 2. In this chapter the arguments of Chapter 3 for the lack of uniformity in Greek culture during the Archaic period (i.e. language and alphabet differences) and the focus on city or polis identity rather than 'hellenic' identity can be addressed.

If we apply the argument that Archaic period Greece was comprised of a series of independent nascent poleis, each with its own identity and customs, we should expect to see in the domesticated animals a greater range of size and shape variation between sites of different regions than for those within the same region. As was discussed previously, Greece in this period lacked a single alphabet, and groups of different regions often spoke different dialects which were not always mutually comprehensible. Considering the scale of inter-regional or panhellenic interaction argued for the Archaic period, we would expect to see differing domesticate varieties in the separate regions of Greece represented by the sites used in this study. If, alternatively, this variation in language and customs between regions was not a barrier to a widespread network of interaction between communities in different regions of Greece, then we might expect to see domestic animals forming a more uniform biometric variety across the wider area of Greece. This interaction would be expected, given the historical developments in interpoleis interactions and alliances recorded for the Classical period, to have increased from the Archaic to the Classical and Hellenistic periods. If this was the case, and differing varieties can be seen across the regions of Greece (and Macedonia) in the Archaic period, we would then expect to see an increase in domesticate biometric uniformity across Greece in the Classical and later Hellenistic periods as opposed to the Archaic period.

With regards to the scale and nature of contacts between Greece and the Adriatic/Ionian regions prior to the settlement of colonies beginning in the Archaic period, the ceramic evidence from the Mycenaean and Dark Age periods suggests (as discussed in Chapter 2) a lack of intensive interactions and trading networks between Greece and either southern Italy and Sicily and the eastern Adriatic coast. From this evidence we would infer that domesticate varieties would be more different between these areas and Greece. This lack of regular and sustained contact would allow us to differentiate biometrically between any identified Greek livestock and the non-Greek indigenous varieties. The trade in amber beads and similarity in metalworking forms (such as fibulae and axes) as discussed in Chapter 2 suggests that at least some contacts existed between these areas in both the Mycenaean period and the Greek Dark Ages. If these areas were in regular contact with Greece, or more specifically were trading livestock (live domestic animals, as opposed to dead-stock or trade in meat) between these areas, we would expect to see both greater similarity in domesticate varieties between Greece and southern Italy or the eastern Adriatic, as well as some indications of variation in domesticate biometry between the indigenous sites in areas with more evidence for trade (such as Torre Mordillo and other sites on the plain of Sybaris) as opposed to those without much trade evidence. In order to test these hypotheses, this chapter examines faunal material from Greek sites, as well as from indigenous sites in the study areas, to determine if the hypothesized 'Greek' and 'indigenous' variety or varieties of livestock can be identified.

In looking for the unique signature of what makes a domesticate group 'Greek', the initial line of inquiry is the traditional examination of taxonomic ratios and age profiles. These are traditional in that they are general calculations taken for nearly every site when a faunal analysis is conducted. They are basic descriptive criteria and are therefore a logical starting point. The hypothesis here is that if 'Greek' taxa are identifiably 'Greek' through a set of culturally specific management practices, this may be visible here. There is no specific evidence, particularly from the Archaic period, for a 'Greek-specific' pattern in livestock preference or management. However, differences in taxonomic preference between cultures has been demonstrated through other studies (see for example Crabtree 1990) and so it is necessary to examine this category of data for cultural patterning.

7.1 Taxonomic Distributions of Greek and Indigenous Sites

The first line of inquiry is the taxonomic ratios of each site in the study. Appendix A shows detailed tables of the major taxa present at each site. These are calculated in both NISP and MNI, where possible. The main distinguishing factor of Greek sites from these tables seems to be the increased variety of taxa seen at sites such as Kassope and Kastanas. This increased variety can be misleading, however, as those sites with a greater number of taxa present are also those with the largest assemblages, as well as being the only settlements. As can be seen in Figure 7.1, when the relative proportions of only the major domestic taxa are compared, sites from Greece show no discernible pattern in taxonomic ratios as compared against indigenous or colony sites. The only possible deviation from this pattern is the marked focus on sheep and goats at Gradina Rat, Skrip and Spila Nakovana as opposed to the Dalmatian Greek colonies. While this is interesting, both settlements are on the island of Brač and it is unclear if this pattern relates to indigenous Later Bronze and (earlier) Iron Age settlements in central Dalmatia (Spila Nakovana being a cave shrine site) or simply those of this particular island. We do not have enough settlement evidence here to securely determine if Greek colonies can be distinguished on the basis of their taxa. The decrease in importance of sheep and goats at these sites as compared to our three indigenous sites is interesting, but does not allow for a firm identification of taxonomic preference as 'Greek'.

Taxonomic preference at a site as forming a category of 'Greek' domesticate usage is even less reliable when we consider the sites of southern Italy. These display no distinct or specific patterning in taxonomic ratios between indigenous and colony sites. Additionally, there is no visible patterning between these Italian colony and indigenous sites and the settlements of Greece. The only potential variation seen from these sites of southern Italy and Sicily is the increased presence of Bos taurus at the Greek colony samples from Eraclea Lucana, Locri Epizephiri, the Classical period of Kaulonia and the Sanctuary at Pantanello. Kaulonia is a settlement whilst the other sample come from sanctuary sites. This increase of cattle is not seen in the Archaic period sample from Kaulonia, nor in the sample from the sanctuary at Lentini. As this increase in *Bos* is not constant across Greek sites nor across a category of colony site it cannot be concluded if this is due to a local variation in the taxonomic preferences of Greek colonists (or sanctuaries) or is an artefact of the data (Kaulonia and Locri Epizephiri having relatively small sample sizes as compared to the other Greek colony sites). At present, the taxonomic variation at southern Italian Greek sites (with an increase of *Bos*) will be noted but left for more detailed consideration in another study, in much the same way as the increased proportion of sheep and goat at indigenous sites of central Dalmatia. Given that no distinct patterning could be found in the comparative taxonomic proportions of the sites in this study we must conclude for the present that there was no evidence in these data for a marked cultural preference for one taxa as opposed to another. The proportions of domesticates recovered from each site is then taken as a variable independent upon the cultural association of the site in question. Now that this has been established we may investigate the implications of age ratios for regional or cultural differentiation.







Figure 7.2: Culling profiles (age-at-death) of *Ovis aries* from Greek sites. The value shown illustrates the porportion of ageable elements which demonstrated survivorship past the age category in question - those elements with fused epiphyses.

7.2 Herd Management: Age-at-Death Profiles

Age-at-death profiles for faunal material recovered from archaeological sites provide data on strategies of herd management and consumption practices. Most bones from archaeological assemblages cannot be aged precisely due to their incomplete nature. The presence or absence of fusion (fused epiphyses) on bones recovered from archaeological sites tells us only that the animal to whom a particular bone 'belonged' died at some point before or after the age at which a given bone fuses. The animal in question could be older or younger by several months or years without this being detected by the state of epiphyseal fusion. That said, it is still possible to compare the proportions of fused and unfused portions of elements recovered to determine what proportion of ageable bones indicate death occurring before or after a given age. This calculation was made for limb elements of *Ovis aries* for sites in the study areas, as the remains of *Bos*, *Sus* and *Capra* were not numerous enough at most sites to provide age profiles. These age profiles, shown in Figure 7.2 as well as A.1 conform to the taxonomic profiles in demonstrating no discernable differentiation by cultural category of site. No age-at-death profiles were made using data from tooth eruption and wear, as the majority of recovered teeth were loose (i.e. not in a jaw) and thus difficult to age precisely. Additionally, dental age data were not available from all or even the majority of sites used for this study.

The distribution for Ovis aries specimens from Greek sites provides a good example of the lack of suitability of culling profiles for determining cultural variation in this study. Figure 7.2 shows the age-at-death profiles for sheep of only one geographic region (Greece), and demonstrates no discernable trend for the five sites given (no age data was available for Kabirenheiligtum bei Theben). There is a considerable amount of variation seen between these five Greek sites (four Greek and one Macedonian). It cannot be stated definitively whether this results from a site or regional preference within Greece with regards to sheep management and slaughter patterns, from variation between religious and settlement sites in Greece (and Macedonia) or possibly even from recovery techniques and sample size (as seen for the Dalmatian sites, see below). No trend in culling profiles was discernable from either colony or indigenous sites of Magna Graecia or Dalmatia. That is to say, Greek sites show no distinction from colony or indigenous sites in the study on the basis of taxonomic ratios or age profiles. Subtle variations, such as a slightly higher percentage of very young animals culled from Dalmatian sites may be either a regional preference in herd management, or may also be a factor of recovery. Sites from Dalmatia with high juvenile mortality are also those which saw fine screen mesh recovery during excavation. It is likely that other sites from at least this region had similar juvenile mortality profiles which have been lost due to less rigorous recovery techniques. For the present, this elevated appearance of very young animals is to be noted with the view that further work carried out in Dalmatia may provide illumination as to any significance. Given the small number of sites for each region of this study which met the necessary requirements of location, chronology, recovery and measurement data the lack of distinct variation in age-atdeath profiles is not entirely surprising at this stage - a much larger meta-analysis of sites from Greece, Italy or Dalmatia would provide a more rigorous test for differentiation based on culling profiles. However, as we will consider below, there are still other data which are better suited to such differentiation.

7.3 Significance of Size and Shape: Biometric Data and 'Greek' taxa

Now that it has been established that taxonomic ratios and culling profiles are insufficient for distinguishing Greek taxa, we shall move on to an investigation of the biometric data from the faunal assemblages. The primary focus of this investigation into the identification of regional domesticate varieties and their movements is on the size and shape of the animals in question. The size and shape of the animals - taken from the size and shape variations in osteological elements recovered from sites - are the same regardless of whether the site was fine sieved or less rigorously recovered. The livestock from a cultural area (defined both in geography and archaeological 'culture' assignations, such as 'Greek' sites) will be of the same size and shape if they are from the same regional interbreeding variety regardless of whether their bones are recovered from a settlement site or a religious shrine. This is the fundamental advantage of a biometrical consideration of regional domesticate varieties. The mixed nature of sites in this study - being both from settlement and sanctuary sites - means that it is through biometry more than any other category of information that we may identify the presence or absence of an identifiable regional variety of Greek domesticates. As described in the previous chapter, it is possible that the use of sanctuary sites may introduce a bias at these sites towards the selection of animals (smaller, larger, younger, male, female, etc.). However, if this is the case we would expect to see patterning in the data between settlement and sanctuary sites of the study groups as previously described.

7.3.1 Teeth

In order to determine if Greek livestock were translocated to colonies it is necessary that we begin with attempting to identify a regionally distinct variety (or varieties) of Greek livestock (as distinct from those of southern Italy and central Dalmatia). For this comparison we first look at the size of the domestic animals from sites in these areas, as seen through the biometric measurements. An initial form of analysis which has the potential to differentiate between regional varieties of domesticates is that of length measurements of teeth. As teeth mineralize in the jaw at an early age and remain relatively unchanged over the life of the animal, unlike the more malleable bones (which can alter in the form of thickening or torsion from musculature, the increase in size of muscle at-

tachments or responses to injury, etc.) they are a prime category of potential data for differentiating between regional varieties of similar size. Teeth of different size may still exist even when two different groups of livestock have separately been bred into the same overall height (Albarella et al 2005:33; Davis and Beckett 1999:13). The number of teeth available for measurement in each site sample is for most sites too small to give any real indications of size. In addition, most sites in the study did not provide biometric data for teeth, severely hampering the utility of teeth data for this study. Due to this paucity of data - particularly from published sources - the tooth size data set is too small to make firm conclusions. It is also unclear for many sites whether measures of tooth length were taken at the occlusal surface or at its base. Particularly in sheep, length measures can vary along the crown of a tooth and can also change with the age of the animal as the tooth wears down. No data was available from published sources as to the wear age of the teeth measured. Nevertheless, it is possible to tentatively analyze trends in the size of domesticate teeth between sites provided these shortcomings are kept in mind. The univariate analyses of the mandibular third molar (M_3) are given below in Figures 7.3, 7.4 and 7.5 for Bos taurus, Ovis aries and Sus domes*ticus*, respectively. The analyses of maxillary M^3 lengths can be seen in Figures B.1, B.2 and B.3. Teeth (third molars) identified to *Capra hircus* were not numerous enough for any of the sites in this study to provide for a comparison of their lengths. In both Bos taurus and Ovis aries there is tentative evidence for a differentiation between Greek and colony and non-Greek indigenous sites in the study areas, but not nearly a large enough data set or a drastic enough distinction in size to firmly separate the two categories. In order to determine the presence of 'Greek' or 'indigenous' livestock varieties we must turn our examination to biometric variation in other, post-cranial elements.



Figure 7.3: Comparison of measures of lengths of mandibular *Bos taurus* third molars (M_3) from sites in the study. Markers here are colour coded following the pattern given in Figure 7.4. All measures given in mm.



Figure 7.4: Comparison of measures of lengths of mandibular *Ovis aries* third molars (M_3) from sites in the study. Markers here are colour coded by site category. All measures given in mm.



Figure 7.5: Comparison of measures of lengths of mandibular *Sus domesticus* third molars (M_3) from sites in the study. Markers here are colour coded by site category. All measures given in mm.

7.3.2 Comparisons of Height

The initial determination of post-cranial variation in potential livestock varieties is to asses the size of the animals in a given area. An assessment of size will provide an initial insight into any patterns in livestock within and between the study groups (Greece as opposed to indigenous southern Italy and central Dalmatia) which may exist. The initial investigation into size variation for these groups is a comparison of height. Height estimates (WRH from the German *Wiederristhöhe*, or height at withers) can be calculated by multiplying length measures (GL) of intact limb elements by factors determined from previous analysis (von den Driesch & Boessneck 1974). These are *estimates* rather than absolute values for the height of the animal as calculations are made on the assumption that limb proportions are the same for the sample animal as for those used to calculate the formula. However, WRH estimates allow for a rapid comparison of size between animals of different sites using length measurements of multiple limb elements simultaneously, thus increasing the size of the sample for initial comparison.

As can be seen in Figure 7.6, the low numbers of intact limb elements for *Bos taurus* means that few sites are available for comparison of height estimates, and even many of those sites with



Figure 7.6: Height estimates calculated for *Bos taurus* on the basis of complete bone lengths following the calculations discussed by von den Driesch and Boessneck (1974). Height estimate ranges are colour coded by cultural site assignation as seen in legend. Height estimate calculations given in mm.

values for comparison may only contain one or two samples. In order to account for individual and sex variation a larger sample size is needed to securely compare sites on this basis. However, the overall impression from this figure is that there is no discernible difference between the heights of animals from Greek sites (ranging between *c*.97 and 135cm at shoulder), indigenous sites (97cm at shoulder) and colony sites (ranging between 115 and 140cm at shoulder). The overlap in height estimates combined with the small number of sites available for study makes it nigh on impossible to argue for any evidence of specifically 'Greek' cattle on the basis of height. While it is possible that Greek cattle may have been of a larger size on average, a much larger sample size, both in terms of sites and measureable elements per site, would be required to conclusively determine this on the basis of height alone.

Figure 7.7, by virtue of both a larger sample size and a greater distinction in size between sample groups, provides a much better representation for height comparison of *Ovis aries*. It is possible for *Ovis* as opposed to *Bos* to calculate height estimates from astragali and calcanei, for



Figure 7.7: Height estimates calculated for *Ovis aries* on the basis of complete bone lengths following the calculations discussed by von den Driesch and Boessneck (1974). Height estimate ranges are colour coded by cultural site assignation as seen in legend. Height estimate calculations given in mm.

which we have far more complete elements than for the major limb bones. The difference is small, only about 10cm difference in mean height estimates and the sample heights for the sites overlap, but the difference still stands. These findings were subjected to a series of Mann-Whitney U tests to determine the statistical significance, the results of which are given in Table D.12. The increased height of sheep from Greek sites is also seen at Greek colony sites in both southern Italy and central Dalmatia, but not at indigenous sites of the Late Bronze Age and Archaic period (contemporaneous with colonies). This provides tentative evidence not only for the existence of 'Greek' sheep but also of their potential presence in colonies. If we can then declare that Greek livestock are Greek by virtue of being larger, our questions become more numerous rather than being satisfied. If Greek sheep were larger than pre-colonisation indigenous varieties, would larger sheep from colony sites to determine the actual movement of livestock or the management of domesticates at colonies towards animals of increased size over the decades or even centuries from the time of initial coloni-sation seen in the available colony assemblages? The Hellenistic period indigenous settlements of

Roccagloriosa and Pomarico Vecchio also contain tall 'Greek-like' sheep; does this indicate trade between indigenous and colony settlements in this period or are these sheep indicative of a larger, indigenous variety? This question will be considered in the following chapter. For now, it is significant only to note that at least for sheep we have good evidence on the basis of height alone for a regional variety of Greek domesticate.



Figure 7.8: Height estimates calculated for *Capra hircus* on the basis of complete bone lengths following the calculations discussed by von den Driesch and Boessneck (1974). Height estimate ranges are colour coded by cultural site assignation as seen in legend. Height estimate calculations given in mm.

The next domesticate up for consideration is the goat, *Capra hircus*. Far fewer goat bones are available from the assemblages considered in this study and this has a corresponding impact on the number of goat bone measurements. The few available estimates for *Capra* height at withers are given in Figure 7.8. There are very few samples available here, but it is clear from this graph that there is no discernible pattern in the height of goats according to the category of site. Goats from Kassope are vastly taller in height estimate than those from the other Greek sites, whereas the pre-colonisation indigenous sites from southern Italy bounce around between the values of Kassope and the other Greek sites (Kastanas and Artemision Olympia). We cannot say from these meagre

data if the increased size of goats at Hellenistic period Kassope indicates an increase in the size of goats in Greece in this period *vis-a-vis* the preceding Archaic and Classical periods (Kastanas and Artemision Olympia); much larger sample sizes from a greater number of sites would be required to determine not only any Greek varieties of goats, but also any changes in them over time.



Figure 7.9: Height estimates calculated for *Sus domesticus* on the basis of complete bone lengths following the calculations discussed by von den Driesch and Boessneck (1974). Height estimate ranges are colour coded by cultural site assignation as seen in legend. Height estimate calculations given in mm.

Height estimates for *Sus domesticus* correspond to site category nearly as well as do those of *Capra hircus*. That is to say, they do not correspond to site category. Unlike with cattle, sheep or goat bones from this region pig bones suffer somewhat from the problems of distinguishing between small wild boar specimens and large domestic pigs. On the basis of measurements larger individuals (according to the measures of individual elements) are often assigned by analysts to *Sus domesticus* or *Sus scrofa* (wild boar), but it is difficult to determine how much if any interbreeding may have occurred at sites in all areas of this study (Albarella *et al* 2005:29). With this caveat in mind, the correspondence between height estimates of the study sites is surprisingly regular. Unfortunately, the height estimates from sites of the various study categories seen in Figure 7.9

show no differentiation by category. While pig bones are more numerous than those of goats from the sites of this study (although not hugely so) the smaller samples of measurable pig bones from Greek sites have yielded height estimates firmly within the ranges of the more numerous samples from indigenous sites as well as those of colony sites. In other words, the large range of variation in height estimates for pigs from sites in this study, along with the lack of clear differentiation in height estimates between site categories, give us no indications whatsoever as to either the existence of a regionally distinct 'Greek' variety of pigs solely on the basis of height, or its possible movement with colonisation.

7.3.3 Univariate Comparisons of Proportions

Height at withers calculations estimate the height of the living animal on the basis of the length of its limb elements. Few intact limb elements for cattle from the sites in the study means a smaller data set for comparison of height estimates. In order to examine the possibility of recognisably Greek cattle we must look at measures other than simply those of limb bone length. Following from this reasoning our next step is to look at a comparison of univariate post-cranial measures measures of only one variable, such as the trochlear breadth of the distal humerus or the greatest lateral length of the astragalus - and examine how cattle from Greek sites compare with those of other sites in the study. The first thing to notice is that cattle from Greek sites are on the whole larger than those of indigenous sites in Italy and Dalmatia. However, within the category of Greek measures, Bos elements from Kastanas are towards the smaller end of the 'Greek' group. This may indicate that Greek cattle, while larger than their indigenous counterparts, are not wholly uniform as a variety across what we think of as Greece. Given the Greek settlement of the coastline around ancient Macedonia and Thrace, it is always possible that the cattle of Kastanas may have been of the same variety as those of other sites in Greece. From this evidence, however, it seems that the Macedonian cattle of Kastanas are not biometrically the same as those from the other sites in Greece.

It is also possible that this variation is caused by selection factors, such as a higher proportion of female animals in the cattle assemblage from Kastanas. While this is not impossible, it would then indicate either a great range of sexual dimorphism for cattle of Greece or potentially a significant preference for young animals. Figure 7.10 shows measures for the astragalus, which does not fuse



Figure 7.10: Comparison of length measures (GLl) of *Bos taurus* astragali for all sites in the study. Size ranges are colour coded by site category. Measures are given in mm.

and therefore could potentially be affected in size by age as well as sexual variation. While it possible that the cattle astragali of Kastanas came entirely or in the majority from young or female animals, the decreased size seen for Kastanas cattle in other univariate element measures of fused (adult) bones seen in Appendix B demonstrate that Kastanas cattle are smaller than those from other sites of Greece for all elements measured. If this decreased size was a product of selection, it would then indicate that only the smallest females were selected at Kastanas and the largest males were selected for other sites of Greece (both settlements and sanctuaries). While not impossible, it is considered here that the differentiation is size between cattle of Kastanas and other sites of Greece more likely indicates a differently sized variety of cattle. In some areas, such as for the length (always the lateral length here) and breadth of the astragalus, sites from the Greek category are noticeably larger than those of indigenous sites from southern Italy, but not necessarily larger than those of colony sites. Figure 7.10 shows a comparison of length measurements for astragali. The differences in mean measurements and to some extent also in the variation of measures can be seen here by site category. These results are also seen in Figures B.4 and B.20. Univariate

comparisons of other elements of *Bos* do not always demonstrate the neat clustering seen here, and sample sizes are too small for most other elements to give conclusive results (see Appendix B). Our quest for the identification of hypothesized Greek cattle will require additional data.



Figure 7.11: Comparison of length measures (GLl) of *Ovis aries* astragali for all sites in the study. Size ranges colour coded by site category. Measures given in mm.

From estimates of height there is a good argument for an identifiable group of sheep in Greece which were taller than those of indigenous sites in the study groups. The question then becomes if a similar clustering can be seen for sheep of Greek sites when individual limb measurements are considered. Figure 7.11 shows a comparison of astragali length for *Ovis aries*. Other univariate comparisons can be found in Appendix B. For sheep of Kastanas, unlike with cattle, we can see a much greater similarity in size between Kastanas and other sites from the (ancient) area of Greece. There is slightly more overlap in the measurements, as can be seen in Figures B.22 to B.40. While not always displayed as neatly as in the figures given here, this pattern continues for all major elements of the appendicular skeleton. Data from univariate comparisons of measurements appear to reinforce the initial suggestions of WRH estimates for sheep. We have larger sheep in Greek and colony sites and a smaller sheep in southern Italian indigenous sites, with another slightly smaller

group in indigenous Dalmatian sites. This still does not solve the mystery of the 20% enlargement of sheep in Greek sites and colonies. These data tell us only that sheep in some sites are enlarged vis a vis sheep in others, not that there is a particular regional variety whose movement might be traced into colonies. For that we need a specific form of investigation - not just the size of the animal, but the shape.



Figure 7.12: Comparisons of proximal breadth (Bp) measures of *Capra hircus* radii. Size ranges colour coded by site category. Measures given in mm.

As no information can be obtained from height estimates which would suggest the presence of a measurably different variety of Greek goats, it is necessary (as with *Bos* and *Ovis*) to examine more univariate measures than simply the overall length of limb elements. These suffer from the same issue of small sample sizes as height estimates, but an interesting pattern (or lack thereof) is evident. For the few elements with enough measures to create graphs, the proximal radius and proximal metacarpal form good examples of the variability in *Capra hircus* size. These are given in Figures 7.12 and B.45, respectively. No pattern of larger Greek site measures and smaller indigenous site measures is apparent. Some indigenous site measures are smaller than their Greek counterparts (such as for the proximal radius) and some colony sites and indigenous sites are larger than Greek ones (such as for astragalus length) and on the whole there is no pattern by site category with each site showing a different pattern. This evidence, combined with that of height estimates, seems to indicate a lack of uniform regional varieties or at the very least a lack of enough information to

argue informatively for or against regional varieties. It is entirely possible that a Greek variety of *Capra hircus* did exist, but that the sample sizes obtained from the sites in this study are not large enough to demonstrate any variation in size.



Figure 7.13: Comparison of distal breadth measures (Bd) of *Sus domesticus* tibiae. Size ranges colour coded by site category. Measures given in mm.

As with *Capra hircus*, a lack of any previous indication of regional varieties for *Sus domesticus* does not preclude us from investigating any possible differences which may be elucidated through a univariate comparison of other measures. As can be seen in Figure 7.13 a comparison of measures of the breadth of the distal tibia show no indications of clustering according to site category. Neither do the other few elements for which it was possible to run such comparisons (see Figures B.41 to B.52 in appendix B for *Capra hircus* and B.53 to B.67 for *Sus domesticus*).

For both *Bos* and *Ovis* we can see clear clusters of larger elements for Greek sites and a cluster of smaller measures for indigenous sites. These data seem to indicate that sheep and perhaps cattle were larger in Greek sites than in the indigenous sites of the study areas. In this way the univariate comparison of element measures reinforces the impression given from the comparison of height estimates. However, the comparison of one measure only tells us of differences in size of each measure, and does not provide a clear picture of differences in the overall shape of elements (and therefore the animals) between the sample sites of each category. In order to determine if the enlarged size of domesticate taxa from colony sites are Greek livestock or indigenous versions managed and/or bred to produce larger individuals, a more rigorous investigation of shape is needed.

7.3.4 Dimensions of Measure: Bivariate Analysis of Greek Livestock

By comparing two or more measures of a single element against one another on the same graph it is possible to get a better understanding of not only the size but the shape of that element for a given site or site category. For this purpose measures of length and breadth, or breadth and depth were plotted against one another in a series of scatter graphs for the sites under analysis. If Greek taxa are distinguished here it will be as a cluster of points (each representing a single measured element) indicating not only similar size but also a similar shape. As with a univariate comparison of element measures, bivariate comparisons require a series of graphs for each of the appendicular elements, most of which are given in Appendix C. A few graphs of the more numerous elements are given here, and a more detailed examination can be made by pausing at each taxon discussed to examine additional graphs in the appendices.

A shortcoming of bivariate analysis of raw measurements, as can be seen below, is that not all elements were complete enough to allow for multiple measures to be taken. The number of available points of comparison (element measures) is thus reduced, sometimes drastically. Additionally, the number of points of comparison (being two or more measures of the same bone which can be compared) is reliant upon the number of measureable elements in each sample. While each site sample provides a number of measured bones, there is rarely a large number of any given element which can be measured. This reduction in the sample size was seen in the above univariate analyses and causes problems in our investigation of shape variation and uniformity here as well. For any element where only one or two measurable elements could be compared (for all sites in the study), the graph was omitted.

In order to gain any significant understanding of the range of both size and shape variation at a site, or between sites of the same category (Greek, indigenous, etc.), it is necessary to have several measurable elements so that the extent of variation can be seen for each site and compared with others. The graphs of bivariate measures must, essentially, have enough points (each representing one measured bone) to show the range of size and shape variation or 'shape distribution' for an element of a given site. It is for this reason that each taxon examined in this section will be con-

sidered in two ways. An initial bivariate analysis of shape for each of the domesticate taxa will be undertaken for Greek sites using 'raw' measures taken from the faunal assemblages. This will serve to give an impression for each element as to variation in size as well as shape between the sites. Following upon this, the sample sizes for such size and shape comparisons will be enlarged through a pooling and standardisation of data using the Log Standard Index technique (see Section 6.3.4). These LSI data will then be compared in a second bivariate analysis, this time comparing the variation in size and shape of all elements.

To investigate the size and shape of cattle from Greek sites as compared with the other site categories, Figure 7.14 shows the spread in size and shape of astragali (here through a comparison of lateral length and breadth) for Greek sites and pre-colonisation indigenous sites of southern Italy and central Dalmatia. It is worth noting here that animals from the Hellenistic period site of Kassope are towards the larger end of the spread along with the Classical and Hellenistic sanctuary sites of Kabiren by Thebes and Poseidon on the island of Tenos. The smaller end of the shape field is almost exclusively from the multi-period site of Kastanas in Macedonia. This suggests, as was seen in the height estimates, that cattle from at least Kastanas do not appear to conform to the biometric patterning seen for cattle of sites in Greece. It is unfortunate for our purposes that a good series of sites with Archaic period samples of *Bos taurus* measures could not be obtained. These 'raw' measures indicated that cattle from Kastanas were not of the Greek variety, but the lack of detailed data for Archaic period cattle from Greece proper makes it difficult to determine if Greece in the Archaic period contained the same biometric variety of cattle seen at the sites of Kabiren bei Theben, Poseidon a Tenos and Kassope. However, in order to maximize what data are available, these later sites will be analyzed for the identification of Greek cattle and then compared to colony sites of both the Archaic and later periods.



Figure 7.14: Bivariate comparison of measures of length (GLl) and breadth (Bd) of *Bos taurus* astragali from Greek sites. Markers here are colour coded by sample category. Measures from Greek sites are indicated by green markers, with red markers for indigenous southern Italian sites. Measures given in mm.

Following upon our earlier indications of the smaller size of cattle from Kastanas as compared with those of the other Greek sites, it is also seen in these bivariate graphs that measures from Kastanas are smaller for all elements seen here. The Kastanas shape field lies more directly within that of the indigenous sites on some occasions (such as for the scapula and metacarpal - see Appendix C) than it does with other sites of the 'Greek' category. The data available give some indications of a decreased variation in length (spread of GL measures) and a comparatively greater variation in the spread of breadth and depth measures. Kastanas cattle, from these data, appear to be of shorter stature but only slightly more gracile than those cattle from other sites of Greece. Kastanas appears from these data to contain its own, slightly smaller regional variety. Further investigation will be needed to decide this point. It may well be the case that a more complete study of the full scope of size and shape of Greek cattle from the Archaic through Hellenistic periods will show Kastanas to be a smaller variant of a larger regional variety, or that it is a separate 'Macedonian' group. The
necessary investigation to settle this question is however beyond the scope of the present inquiry. A larger survey of cattle biometry from sites in Greece, containing a large sample of complete limb elements, will be needed to investigate the case of the curiously curtailed height of Kastanas cattle.



Figure 7.15: Bivariate comparison of measures of length (GLl) and breadth (Bd) of *Bos taurus* astragali from Greek sites with the exception of Kastanas. Markers here are colour coded by sample category. Measures from Greek sites are indicated by green markers, with red markers for indigenous southern Italian sites. Measures given in mm.

Figure 7.15 shows the same bivariate graph of cattle astragali from Greek sites coupled with indigenous sites from pre-Greek colonisation southern Italy. In this instance the site of Kastanas has been removed to demonstrate more clearly the differentiation in size and shape between Greek and indigenous cattle. This graph serves to illustrate the clustering of data points from cattle of Greek sites (with the exception of Kastanas) when contrasted against the clustering of points from cattle astragali of the earlier indigenous sites. This separation of shape fields (Greek and indigenous) can also be seen on other well-represented elements, which are given in Appendix C, in Figures C.1 to C.10. The statistical significance of associations in the size and shape of cattle astragali between sites of Greece was subjected to a series of Mann-Whitney U tests following the formula in Section



Figure 7.16: Bivariate comparison of measures of length (GLl) contrasted with the division of breadth (Bd) by depth (Dl) of *Bos taurus* astragali from Greek sites. In this Figure the markers from the site of Kastanas have been removed. Markers are again colour coded by sample category. Measures from Greek sites are indicated by green markers, with red markers for indigenous southern Italian sites. Measures given in mm.

6.3.4. The results of these tests are given in Tables 7.1 and 7.2.

Given the sparse representation of measurements of *Bos taurus* (as compared with *Ovis aries*, see below) it is necessary to expand the data sample for each site as far as possible without a corresponding loss to information on the shape of the animals in this study. To this end data, from Greek sites has been converted into LSI values using the formula given in Section 6.3.4. Data was converted into LSI values according to its shape proportion, meaning that length, proximal and distal breadths and proximal and distal depths were kept as separate categories of LSI. In this way, the shape as well as the size of *Bos taurus* can be examined from Greek sites. An example of such proportional LSI data is given in Appendix C.

Site	Kastanas	Kabiren bei Theben	Poseidon a Tenos*	Kassope
Kastanas	-	reject	reject	reject
Kabiren bei Theben	reject	-	accept	reject
Poseidon a Tenos*	reject	accept	-	accept
Kassope	reject	reject	accept	-

Table 7.1: Summary of Mann-Whitney U tests performed on measures of astragalus length (Gl), breadth (Bd) and depth (Dl) of *Bos taurus* for Greek sites. Those tests which displayed the same distribution of measures between sites are marked as "accept", meaning that we accept the null hypothesis that cattle from these sites have the same size and shape distribution. Those tests which did not display the same distribution of measures between sites are marked as "reject" for 'reject the null hypothesis'. Those sites with fewer than five measured astragali are marked with an asterisk (*) to indicate that the sample tested fell below the recommended minimum size (5) of a sample for the Mann-Whitney U test. While these results (in this case for Poseion a Tenos) are reported, they should be taken more tentatively than those from sites with larger samples. As can be seen from these tests, there is no indication that the cattle from Kastanas (or at least their astragali) are of the same variety as that from the other three sites with *Bos* astragali. The p-values from each Mann-Whitney U test used for this summary are available in Tables D.3, D.4 and D.5.

Site	Coppa Nevigata	Termitito*	Torre Mordillo*
Coppa Nevigata	-		accept
Termitito		-	
Torre Mordillo	accept		-

Table 7.2: Summary of Mann-Whitney U tests performed on measures of astragalus length (Gl), breadth (Bd) and depth (Dl) of *Bos taurus* for indigenous sites of southern Italy. Those tests which displayed the same distribution of measures between sites are marked as "accept", meaning that we accept the null hypothesis that cattle from these sites have the same size and shape distribution. Those tests which did not display the same distribution of measures between sites are marked as "reject" for 'reject the null hypothesis'. Those sites with fewer than five measured astragali are marked with an asterisk (*) to indicate that the sample tested fell below the recommended minimum size (5) of a sample for the Mann-Whitney U test. While these results are reported, they should be taken more tentatively than those from sites with larger samples. The site of Termitito, with only one set of astragalus measures, could not be subjected to this test. These tests provide evidence of the sites dating before Greek colonisation containing cattle astragali of the same variety. The p-values from each Mann-Whitney U test used for this summary are available in Tables D.3, D.4 and D.5.

As with the bivariate analyses of raw data, cattle from Greek sites seen through shape LSI data cluster neatly together into a shape distribution with the exception of Kastanas, as seen in Figures 7.17 and 7.18. For these data the mean LSI values have been marked for each site, with crosshairs to show the range of one standard deviation from the mean. These better illustrate the shape distribution for the compared LSI proportions of each site. As before, when Kastanas data are removed, a distinct shape distribution can be seen for cattle from Greek sites, as seen in Figure 7.19. This is not far removed from the shape distribution of cattle from the earlier indigenous sites of southern Italy, but is distinct nonetheless. This distribution can be seen for Greek cattle regardless of which LSI shape proportions are compared.

It is however not enough simply to observe visual differences in shape field upon a scatterplot. Even a series of scatterplots is insufficient to argue conclusively that Greek cattle existed, at least as early as the Classical period if not in the Archaic. Our arguments for the existence of regionally distinct shapes of Greek cattle in the Archaic would be more secure provided that cattle from Kastanas had conformed to the shape fields for our other Greek sites, or if other suitable Archaic period Greek samples could be located. For this examination, its presence in Classical period samples will have to be sufficient. In order to confirm the data seen through bivariate raw and LSI analysis, shape LSI data were subjected to a multiple runs of the Mann-Whitney U. This is the most suitable test to compare population samples of nonparametric data using samples of different sizes. Through this test we were able to determine whether or not the Greek samples observed came from the same or different population shape groups. These results of these tests are given in Table 7.3, as well as Tables D.7 to D.11. These statistical tests confirmed the visual findings for a Greek variety of cattle seen in the sites of (ancient) Greece but not at the site of Kastanas. The presence of a separate variety of indigenous cattle at the pre-colonisation sites of southern Italy was also confirmed.



Figure 7.17: Bivariate shape analysis of LSI indices. This graph compares indices of length (Gl) and proximal breadth (Bp) of Bos taurus. LSI values have been multiplied by 100 in this graph for ease of display. Shown here are LSI values for remains from Greek sites (in green), pre-colonisation indigenous Italian sites in red, Gradina Rat of central Dalmatia in purple, and the Archaic period (early colonisation) site of Incoronata in the pink and green triangle. Mean length and breadth LSI values for each site are given with crosshairs showing one standard deviation.



Figure 7.18: Bivariate shape analysis of LSI indices. This graph compares indices of length (Gl) and proximal breadth (Bp) of Bos taurus. LSI values have been multiplied by 100 in this graph for ease of display. Shown here are LSI values for remains from Greek sites (in green), pre-colonisation indigenous Italian sites in red, Gradina Rat of central Dalmatia in purple, and the Archaic period (early colonisation) site of Incoronata in the pink and green triangle. Mean length and breadth LSI values for each site are given with crosshairs showing one standard deviation. In this graph, values for the site of Kastanas have been removed (excepting the mean) to highlight the shape differentaiation of Greek and indigenous cattle.



Figure 7.19: Mean values of bivariate LSI shape analysis of Bos taurus indices of length (Gl) and proximal breadth (Bp) from Greek sites and indigenous sites of southern Italy. Points represent mean LSI values for each dataset and crosses show range on one standard deviation. Values on axes represent LSI values multiplied by 100.

Torre	Mordillo		accept	reject	reject	reject	reject	accept	I
Termitito*			accept	reject	reject	reject	accept	I	accept
Coppa	Nevigata		reject	reject	reject	reject	1	accept	reject
Kassope			reject	accept	accept		reject	reject	reject
Poseidon a	Tenos*		reject	accept	1	accept	reject	reject	reject
Kabiren	bei	$Theben^*$	reject	I	accept	accept	reject	reject	reject
Kastanas			I	reject	reject	reject	reject	accept	accept
Site			Kastanas	Kabiren bei Theben*	Poseidon a Tenos*	Kassope	Coppa Nevigata	Termitito*	Torre Mordillo

distribution of measures between sites are marked as "accept", meaning that we accept the null hypothesis that cattle from these sites Table 7.3: Summary of results of Mann-Whitney U tests performed on LSI data of Bos taurus. Those tests which displayed the same have the same size and shape distribution. Those tests which did not display the same distribution of measures between sites are marked as "reject" for 'reject the null hypothesis'. As can be seen from these tests, there is no indication that the cattle from Kastanas are of the same variety as that from the other three sites of Greece.



Figure 7.20: Bivariate comparison of measures of length (GLl) and breadth (Bd) of *Ovis aries* astragali from Greek and indigenous sites. Each point represents the measures of a single astragalus. Points are colour coded by site category, with Greek sites in green, indigenous southern Italian sites in red, and Gradina Rat in central Dalmatia in purple. Measures given in mm.

With the findings for *Bos taurus* in mind we can now turn to an analysis of measures of Greek *Ovis aries*. Univariate analysis of *Ovis* measures provided strong indications for the existence of a regional variety of Greek sheep. As can be seen in Figures 7.20 through 7.21 this indication holds well for the bivariate data also. Unlike with cattle, the site of Kastanas sits well within the shape distribution exhibited for Greek sheep, showing only a slight variation and not the distinct difference seen with cattle shape data. This is interesting as the site of Kastanas is not formally included in ancient 'Greece' and is Macedonian in affiliation. Nonetheless, it still appears to contain 'Greek sheep'. The existence of Greek sheep is also well evidenced in the Archaic period sample of Artemision Olympia, which unfortunately did not yield post-cranial measurements for cattle. As can be seen in Figures 7.20 and 7.21, the shape distributions of Greek taxa can be distinguished neatly from those of others, such as the earlier southern Italian indigenous taxa, through the distribution of their markers. To ease interpretation, these shape distributions have been given the same colour for each site category (as seen for *Bos taurus*).

As with cattle, raw measures for sheep are not plentiful enough to make detailed comparisons



Figure 7.21: Bivariate comparison of measures of distal breadth (Bd) and depth (Dd) of *Ovis aries* tibiae from Greek and indigenous sites. Each point represents the measures of a single tibia. Points are colour coded by site category, with Greek sites in green, indigenous southern Italian sites in red, and Gradina Rat in central Dalmatia in purple. Measures given in mm.

of shape in the identification of Greek sheep. The largest element datasets have been given here, but a perusal of other raw bivariate data comparisons given in Appenix C detail the meagre sample sizes when individual elements are compared. Greek measurements for *Ovis aries* have therefore been converted into LSI values following their shape categories, as described for *Bos taurus*. An example of shape category LSI bivariate comparisons is given in Figure 7.22, contrasting LSI values of length with those of proximal breadth. This also shows a clear shape cluster for Greek sheep, made more apparent by a comparison of mean LSI values for each site considered, as well as the increased sample size. The mean value markers here are more tightly clustered than for the raw measures, indicating the similarity of size and shape between sites more clearly. These data provide a strong argument for the existence of a regional variety of Greek sheep identifiable through their size and shape profile.

In order to test the observations and indications of a regional variety of Greek sheep given by

these graphs it is necessary to test the data statistically. As with cattle, these data are subjected to a series of Mann-Whitney U tests to determine the uniformity in size and shape profiles as having originated from the same shape population. The results of these tests can be seen in Tables 7.4 to 7.5, as well as D.13 to D.22. As can be seen, all sites considered from Greece come out as statistically significant - that is, all sites contain livestock of the same regional variety. As we can see here, samples of measurements from the Greek sheep variety come out as significant (e.g. from the same shape population) when compared to one another, but not when compared to sheep from pre-colonisation indigenous sites. As can be seen both in the graphs and statistical assessments for Greek sheep, there is clear evidence not only for the existence of a regionally distinct variety of Greek sheep as early as the Archaic period, but we can also identify a regional variety of sheep for Late Bronze Age (pre-colonisation) indigenous sites of southern Italy.

With regard to the less numerous measures for *Sus* and *Capra*, which were seen earlier to demonstrate no distinctive pattern with regards to a Greek domesticate variety, we can see from bivariate analyses in Figures 7.25 through 7.30 that sample sizes still remain woefully small. Both taxa continue to display no coherent groupings by region or cultural site assignation. From these data we can deduce that either there existed no measurably distinct variety of Greek goat or pig, or that such a variety may have existed (indeed, more than one) and the sample sizes from each site are simply too small to distinguish the necessary shape patterns. This confusion is compounded by the plasticity and possible interbreeding of *Sus domesticus*, as described above. We will return briefly to these troublesome taxa in the next chapter to examine their size and shape patterning in areas of colonisation, but for the present indications are not optimistic for the identification of regionally distinct varieties of *Capra hircus* or *Sus domesticus* until an exponentially larger dataset can be compiled for Greece. Even then, it is not indicative from these findings that any regional patterning may be observed.



Figure 7.22: LSI values of bivariate shape analysis of Ovis aries indices of length (GI) and breadth (Bp) from Greek sites, indigenous sites of southern Italy and of central Dalmatia. Points represent mean LSI values for each dataset and crosses show range of one standard deviation. Values on axes represent LSI values multiplied by 100.



indigenous sites of southern Italy and of central Dalmatia. Points represent mean LSI values for each dataset and crosses show range of Figure 7.23: Mean LSI values of bivariate shape analysis of Ovis aries indices of length (Gl) and breadth (Bp) from Greek sites, one standard deviation. Values on axes represent LSI values multiplied by 100.





showing all values for proximal breadth and depth of Ovis aries elements is given in Figure C.19 of Appendix C.



Figure 7.25: Comparison of distal breadth (Bd) and depth (Dd) of *Capra hircus* tibiae from sites of Greece and indigenous sites of southern Italy and central Dalmatia. Markers are colour coded by site category. Measures given in mm.



Figure 7.26: Comparison of length (Glpe) and breadth (Bp) of *Capra hircus* first phalanx from sites of Greece and indigenous sites of southern Italy and central Dalmatia. Markers are colour coded by site category. Measures given in mm.

Torre Mordillo	reject	reject	reject		reject	accept		I
Termitito*							I	
Coppa Nevigata	reject	reject	reject		reject	1		accept
Kassope	accept	accept	accept		I	accept		reject
Poseidon a Tenos*				I				
Kabiren bei Theben	accept	accept	I		accept	reject		reject
Kastanas	accept	I	accept		accept	reject		reject
Artemision Olympia	I	accept	accept		accept	reject		reject
	Artemision Olympia	Kastanas	Kabiren bei Theben	Poseidon a Tenos*	Kassope	Coppa Nevigata	Termitito	Torre Mordillo

	lo									
Torre	Mordil	reject	reject	reject	reject		reject	accept	accept	-
Termitito		reject	reject	reject	reject		reject	accept	I	accept
Coppa	Nevigata	reject	reject	reject	reject		reject	1	accept	accept
Kassope		accept	accept	accept	accept		ı	reject	reject	reject
а										
Poseidon	Tenos*					I				
oiren bei	chen	ept	ept	ept			ept	ct	ct	ct
Kal	The	acc	acc	acc	ı		acc	reje	reje	reje
Herakleion	de Thasos	accept	accept	1	accept		accept	reject	reject	reject
Kastanas		accept	I	accept	accept		accept	reject	reject	reject
Artemision	Olympia	I	accept	accept	accept		accept	reject	reject	reject
Site		Artemision Olympia	Kastanas	Herakleion de Thasos	Kabiren bei Theben	Poseidon a Tenos*	Kassope	Coppa Nevigata	Termitito	Torre Mordillo

Table 7.5: Results of Mann-Whitney U tests performed on LSI values of Ovis aries from Greek sites and pre-colonisation indigenous values according to proportions are marked as "accept", meaning that we accept the null hypothesis that the sheep from these sites come than one proportion did not display statisitcal significance are marked as "reject", meaning that we must reject the null hypothesis. Those and therefore where it was impossible to perform a comparison, have been left blank. The p-values from which these summary results sites of southern Italy. Those sites for which there is a statisitcal significance in the size and shape of sheep on the basis of their LSI from the same size adn shape variety. In order for a comparison between two sites to be considered as having 'passed' the test, all or at least the length and breadth (three out of five tests) LSI values must have displayed statisitcal significance. Those sites for which more sites for which there are not enough samples for a rigorous run of the Mann-Whitney U test (e.g. fewer than five) are marked with an asterisk. Those for which there were no samples or only one or two samples for each proportional comprison (as with Poseidon a Tenos), were obtained can be seen in Tables D.23 to D.27



Figure 7.27: Comparison of proportional LSI values for length (GI) and breadth (Bp) of Capra hircus of Greek and earlier indigenous southern Italian sites. Markers are colour coded by site category. LSI values have been multiplied by 100 for ease of display.



Figure 7.28: Comparison of length (GLl) and breadth (Bd) of *Sus domesticus* astragali for sites of Greece and indigenous sites of southern Italy and central Dalmatia. Markers are colour coded by site category. Measures given in mm.



Figure 7.29: Comparison of distal breadth (Bd) and depth (Dd) of *Sus domesticus* tibiae from sites of Greece and indigenous sites of southern Italy and central Dalmatia. Markers are colour coded by site category. Measures given in mm.



earlier indigenous southern Italian sites. Markers colour coded by site category. LSI values have been multiplied by 100 for ease of Figure 7.30: Bivariate comparison of proportion LSI values of length (GL) and proximal breadth (Bp) for Sus domesticus of Greek and display.

While there is no indication from our examination of Greek livestock for the existence of local varieties of goats or pigs, we have demonstrated good arguments for the existence of measurably distinct varieties of cattle and sheep in Greece. We have also from these data been able to identify a regionally distinct and statistically significant variety of sheep within the sampled sites of pre-colonisation Late Bronze Age southern Italy. From this we can prove that the first hypothesis is correct. It is possible to distinguish varieties of livestock by culture or region through biometrical comparison of faunal material. As discussed at the beginning of this chapter, these findings, coupled with the uniformity of size and shape for the identified variety of sheep across Greece (and Macedonia) from the Archaic period, and the more tentative evidence for uniformity in cattle from the Archaic period onwards, indicate that arguments for a fragmentary nature of Greece in the Archaic period are not supported by the domesticate biometry. While the ethnic affiliation of individuals with nascent poleis, as well as variation in local language and alphabet may well have existed, the domesticate biometry suggests an interlocking network of contacts and interactions between groups across the regions of ancient Greece from as early as the Archaic period. The identification of a regional indigenous variety of sheep and cattle in southern Italy indicates that trade contacts between Greece and this region prior to colonisation were not intensive and sustained, or at the very least did not involve the trade in livestock which bred with local varieties. Compared with the uniformity of Greek sheep and cattle, the domesticates of southern Italy and central Dalmatia are more diverse in size and shape between sites, suggesting a less uniform pattern of interbreeding between sites in these regions than seen for Archaic Greece. While not as uniform as cattle and sheep of ancient Greece, these pre-colonisation indigenous varieties of Italian cattle and sheep are distinct from those of Greece both visually (in graphs of their biometry) and statistically. This variation suggests that contacts between these areas prior to colonisation were not intensive, or at least did not involve the trade in or inter-breeding of livestock.

This finding will prove useful in the next chapter when the identified Greek cattle and sheep are compared with textually identified Greek colony sites of both Magna Graecia and central Dalmatia. Identified Greek livestock varieties of cattle and sheep will be compared with those of 'colony' and 'indigenous' sites from both areas to determine first if sheep and cattle were translocated to colonies with the process of Greek colonisation, and then if evidence can be found for the mingling of Greek and indigenous herds in either colony or indigenous sites.

Chapter 8

The Shape of Things That Come: Greek Taxa and Colonisation

In the choice therefore of your sheepe, choose the biggest boned, with the best wooll; ... These sheep ... are alwaies the best butchers ware, and goe the soonest away in the market. [[sic] Gervase Markham. 1631. Cheape and Good Husbandry for the Well-Ordering of All Beasts and Fowles, and for the Generall Cure of Their Diseases, Pp 108-9 (Davis and Beckett 1999:1).]

Were Greek colonies established and maintained by colonists as a continuation of the settlement and society of the Greek motherland? Were indigenous and colony settlements mingled or involved in a trading relationship? Did one group come to supplant the other, or did some exist in clear separation whilst others shared together and merged? While the movement of domesticate varieties will not tell us everything we may desire to know about the nature of Greek colonies, it can be added to further lines of evidence to aid in a better understanding of Greek colonisation and its impact upon indigenous communities. Now that we have strong evidence for the identification of Greek varieties of cattle and sheep, the next step is to examine whether these varieties can be seen in Greek colonies of southern Italy and central Dalmatia. If Greek varieties of livestock can be identified at historically 'known' Greek colonies, this would serve to reinforce not only the identification of these sites as Greek colonies (or colonial sanctuaries) but would also indicate a degree of organisation in the settlement of these colonies. Given the size of cattle and sheep it is argued that their translocation would imply the organisation at least of wholesale resettlement by families or groups of families (however small) from Greece in the identified colonies. The presence of 'Greek' livestock at a colony site (as opposed to indigenous or heavily mixed varieties) would therefore indicate a strong socio-political or cultural affiliation of the site in question, with the livestock taken as a proxy for the settlement of the colony by Greeks as a Greek colony and not only the piecemeal movement of a few families to settle on foreign shores. A Greek livestock size and shape profile at colony sites, in other words, would indicate that the livestock, and presumably therefore the inhabitants of this site would have been at least largely comprised of the Greek variety (of humans) translocated with colonisation. As with Chapter 7, this examination of taxa from colony sites will begin with an examination of the biometry of *Bos taurus*.

8.1 Domesticates, Translocation and Southern Italy

Figure 8.1 shows a comparison of cattle astragali for southern Italian indigenous and colony sites as well as those of Greece. The point to note here is that the only overlap seen in the colony and indigenous shape distributions is the site of Incoronata. This graph illustrates well the suggestion that taxa from colony and indigenous sites were different. The area of overlap between the size and shape of taxa (via the astragalus) of Greek and southern Italian colony sites can be seen in Figure 8.1. The area of overlap between size and shape of distal tibia from indigenous and colony sites of southern Italy can be seen in Figure 8.2. While data from raw measures do not provide large samples for cattle from colony sites, what data we do have give associations with cattle from Greek sites. As can be seen in Figures 8.1 and 8.2, cattle from colony sites such as Kaulonia or the sanctuary at Pantanello appear to be in the mean slightly larger and more robust than cattle from Greek sites.¹ On the whole, however, cattle from colony sites conform much more closely in these data (see below and Appendix C) to the size and shape of those from Greek sites. From these data we can see that the later period indigenous sites of Incoronata and Roccagloriosa do not conform as neatly in size and shape as the earlier indigenous sites. In both figures, Incoronata occupies a middle ground between the distributions of Greek/colony and earlier indigenous cattle. The site of Roccagloriosa, as seen in Figure 8.2 gives evidence of cattle larger than those of the other pre-Greek and Archaic period sites. The large size of cattle from Roccagloriosa can be seen both in the distal tibia (Figure 8.2) and in bivariate raw measure comparisons in Figures C.1 to C.10. The

¹It should be remembered, when considering domesticates of the sanctuary at Pantanello, that this site dates from the sixth to the third centuries BC, making it a century too late in the end of its usage according to the chronological restrictions for study sites of southern Italy. It was included (as discussed in Chapter Six) by virtue of its geographical proximity to the majority of indigenous sites in the study. However, the presence of possible Republican influence on domesticates is possible for this site, and cannot be quantified or controlled for in the biometry in the absence of detailed data on Republican Roman cattle biometry for this area.

significance of these larger cattle from Roccagloriosa is not only that they are unlike those of other indigenous sites, but that they fit neatly within the distribution of Greek and Greek colony sites for this area. The site of Monte Irsi (which spans not only the Iron Age but also the Hellenistic Period, and therefore the entire period of Greek colonisation) can be seen in Figure 8.2 to sit clearly within the shape field for pre-colonisation indigenous cattle of southern Italy. In Figures C.4 and C.5, however, it can be seen to lie within the overlap area (between indigenous and Greek sites) alongside the site of Incoronata.



Figure 8.1: Comparison of length (GLl) and breadth (Bd) of *Bos taurus* astragali for Greek sites and indigenous and colony sites of southern Italy and Sicily. Markers colour coded by site category. Measures given in mm.

With the expanded sample set available from conversion of raw measures into LSI values we can see the trends from individual cattle elements more clearly expressed (Figure 8.3). When we compare data points of colony and indigenous sites of southern Italy against one another the pattern seen before is even more strongly expressed, with indigenous sites demonstrating animals not only



Figure 8.2: Comparison of breadth (Bd) and depth (Dd) of *Bos taurus* distal tibia of indigenous and colony sites of southern Italy and Sicily. Markers colour coded by site category. Measures given in mm.

shorter in stature but much more gracile (compared with Greek and colony cattle). The colony sites are clustered together at the larger and more robust end of the distribution along with cattle of Greek sites, with some overlap between indigenous and colony groups on the margins of their shape distributions. Incoronata is no longer visible as the intermediary site in between the size and shape distributions of the two groups (Greek/colony and indigenous), and some clustering of points by site is also apparent. On the whole, the original impression of cattle from colony sites as being distinct in size and shape from indigenous sites is retained. From Figures 8.4 and 8.6 it is clear that this difference (from indigenous sites) in colony cattle size and shape is related to that of cattle from Greek sites. The partial clustering of individual colony sites can still be seen, as with the clustering of Greek sites within the overall shape field. The site of Lentini is interesting here, as it sits (in its mean) alongside Incoronata and almost directly overlaps the mean LSI value of Coppa Nevigata in Figure 8.4, but sits at the more robust end of the Greek shape distribution almost overlapping the

site of Kassope in Figure 8.6. This suggests robust cattle (greater width and breadth of elements) comparable to those of other colony sites in the area, albeit of smaller stature (height or length of elements). It should be noted here that this reduced stature is not necessarily because cattle of this site date from the Archaic period. As can be seen in Figure 8.1 the solitary cattle astragalus from Kaulonia (Archaic) forms a large outlier on the graph; it is also seen in Figure 8.4 to have Greek cattle.

From a combination of raw data by element and LSI data by overall proportion it can be seen that cattle from colony sites of southern Italy and Sicily conform more readily to those of Greek cattle than the pre-colonisation indigenous sites of the region. While not exactly within the shape field for Greek cattle, these colony cattle do indicate the movement of cattle from Greece into colony sites in this region of colonisation. The patterning of colony sites of both the Archaic colonisation period as well as later period samples indicates that at least the majority of animals which made up herds of Greek colony livestock were or were descended from translocated animals from Greece. The inexact shape patterning of cattle data from colony sites suggests that colonial cattle of southern Italy and Sicily may have been interbred to a small extent with indigenous livestock (particularly for Lentini as suggested by Figures 8.6 and 8.4) or were intermingled with a differing regional variety, either from trade in live animals or in dead ones for meat. It is also possible from these colony biometric data that Greek and indigenous livestock herds were intermingled and bred specifically for increased stature and robusticity as compared with indigenous cattle varieties. As colony site distributions of cattle size and shape so closely resemble those of Greek sites it seems more likely that these cattle were translocated Greek varieties (see below and Appendix D). However, the small but identifiable variation in cattle between colony sites cannot rule out specific intermixing and 'improvement' of indigenous cattle. Given that the biometric data available provides us only with general measurements of three planes for the elements in this study (length, breadth and depth), the more specific nature of colony cattle (i.e. intermingled/interbred varieties or two separate varieties in one sample) cannot be ascertained. A larger data set and more refined measurement techniques would be required to securely determine the composition of southern Italian colonial cattle.

There are two distinctions from the shape distributions of Figures 8.4 and 8.6, however, which deserve note. Firstly, cattle from the sanctuary of Pantanello, while conforming within the overall shape field for Greek cattle, are more robust (e.g. greater breadth) than the mean of Greek cattle.

As this sample comes from a sanctuary site, it is possible that these more robust cattle are the result of a selection bias at this sanctuary for more robust cattle, such as bulls. It is also possible that these cattle come from later periods in the use of the site. As no more data are available on this possibility and the other Greek sanctuaries in the study do not display a bias towards more robust cattle this observation is currently exceptional. Further studies of cattle size and shape from Greek sanctuaries of both the Republican (Late Hellenistic) and earlier periods could provide more information as to the reason for the robust cattle of the sanctuary at Pantanello.

The second observation to consider from these data is that of the post-colonisation indigenous sites. As to the herd composition of later period indigenous sites (post-colonisation) as well as the debated greco-indigenous site of Incoronata, the size and shape data for cattle seen in the above figures provides some interesting insights. From the data of these sites, it is suggestive that these three later period sites contained an intermediary variety of Greek and indigenous cattle, as they all lie in their shape distributions between those of indigenous pre-colonisation and Greek livestock, and do not conform wholly to either these groups or the cattle of Greek colonies studied. This middle ground in the graphs given above indicates cattle of a shape mixed between the other groups. This does not necessarily imply that the cattle of these sites were uniformly mixed in size and shape between the cattle of Greek, Greek colony or indigenous varieties; these data may as easily indicate that the herds kept at these sites contained livestock of more than one variety. Whether cattle from these later period indigenous sites were uniformly mixed or of multiple types cannot be distinguished with the data we have available. However, the distributions of all these sites located more firmly towards the shape of Greek and colonial cattle does suggest that at least some intermingling of Greek taxa occurred at these sites. With regards to the associations seen from raw and LSI plots of cattle data for colonial and later period indigenous sites for the southern Italian region, the statistical significance of findings was subjected to Mann-Whitney U tests as seen for cattle of Greek sites. The findings of these tests can be seen in Table 8.1 as well as Appendix D. From these tables we can see that the findings of the visual assessments of the biometric data are significant, with Greek cattle present at Kaulonia and Eraclea Lucana, and potentially also at Lentini and the Sanctuary at Pantanello. Unfortunately, even LSI data from Bos taurus rarely yielded enough values for each colony site to rigorously test for the presence of Greek cattle. The larger size of some cattle from Pantanello (as mentioned previously) also makes it difficult to test statistically for the presence of Greek cattle. While the visual biometric data are highly suggestive of Greek cattle varieties at these colony sites, more data will be required to definitively declare their presence. With regards to the presence of Greek cattle at the later-period indigenous sites of Incoronata, Monte Irsi, Pomarico Vecchio and Roccagloriosa, statistical data from these sites is indeterminate in significance between cattle of Greek or pre-colonisation indigenous varieties. Sample sizes again are insufficient for a definitive identification, but the mixed size and shape patterning of cattle at these sites does indicate a mixed variety (or the presence of multiple varieties).



Figure 8.3: Plot of length (Gl) and proximal breadth (Bp) LSI values of Bos taurus for Greek sites and indigenous and colony sites of southern Italy. Markers colour coded by site category. For ease of display, LSI values have been multiplied by 100. Means given with crosshairs showing one standard deviation.



Figure 8.4: Plot of length (Gl) and proximal breadth (Bp) LSI values of Bos taurus for Greek sites and indigenous and colony sites of southern Italy. For ease of display, LSI values have been multiplied by 100. Means given with crosshairs showing one standard deviation.



Figure 8.5: Plot of LSI values of breadth (Bp) and depth (Dp) of Bos taurus from Greek sites and indigenous and colony sites of southern Italy. Markers are colour coded by site category. For ease of display, LSI values have been multiplied by 100. Markers with crosshairs illustrate mean LSI values for each site with crosshairs showing one standard deviation.



Figure 8.6: Plot showing summary of breadth (Bp) and depth (Dp) LSI values of Bos taurus from Greek sites and indigenous and colony sites of southern Italy. Markers are colour coded by site category. For ease of display, LSI values have been multiplied by 100. Markers illustrate mean LSI values for each site with crosshairs showing one standard deviation.



Figure 8.7: Graph of bivariate comparison of measures of length (Gl) and breadth (Bd) of *Ovis aries* astragali from Greek sites (green), as well as indigenous (red) and colony (blue) sites of southern Italy. Measures given in mm.

When colony and indigenous sites for southern Italy are added to a bivariate graph of astragali length and breadth of *Ovis aries*, as they are in Figure 8.7, it is clear that indigenous sites for the most part hang from the shorter and more gracile end of the Greek shape distribution, whereas measures from colony sites (for the most part) cluster neatly within its boundaries. This pattern is seen not only for the astragalus but for other elements as well. As can be seen here and in Figure 8.8, from which data points from Greek sites have been removed, data from the later period site of Pomarico Vecchio sit neatly within the shape field for Greek and colony sites, demonstrate the same distribution of clustering for colony sites of this region as seen for the astragalus. Reminiscent of cattle data, the site of Roccagloriosa yields few measures for sheep. Those measures which can be plotted bivariately are seen in Figure 8.10, where it is apparent that the sheep contributing these astragali did not come from the same population shape as either the Greek or earlier indigenous

					_								
Eraclea	Lucana	reject	reject	accept	accept	accept		reject	reject	accept	reject	accept	I
Kaulonia		reject	accept	accept	accept	accept	reject	reject	accept	accept	reject	ı	accept
Pantanello	Sanctuary	reject	reject	reject	reject	reject	reject	reject	reject	reject	ı	reject	accept
Lentini		accept	reject	accept	reject	accept		reject	accept	I	reject	accept	accept
Pomarico	Vecchio	accept	reject			accept	reject	reject	,	accept	reject		
Roccagloriosa		reject	accept	reject	reject	reject	reject		reject	reject	reject	reject	reject
Monte Irsi						accept	1				reject	reject	
Incoronata		reject	reject	reject	reject	1	accept	accept	accept	accept	reject	accept	accept
Kassope		reject	accept	accept	,	reject		reject		reject	reject	accept	fail
Poseidon a	Tenos	reject	accept	1	accept	reject		reject		reject	reject	accept	fail
Kabiren bei	Theben	reject	,	accept	accept	reject		reject		reject	reject	accept	fail
Kastanas		I	reject	reject	reject	reject		reject		reject	reject	reject	fail
Site		Kastanas	Kabiren bei Theben	Poseidon a Tenos	Kassope	Incoronata	Monte Irsi	Roccagloriosa	Pomarico Vecchio	Lentini	Pantanello Sanctuary	Kaulonia	Eraclea Lucana

Table 8.1: Summary of results of Mann-Whitney U tests performed on LSI data of *Bos taurus* indices. Those sites for which there is a meaning that we accept the null hypothesis that the sheep from these sites come from the same size and shape variety. In order for a comparison between two sites to be considered as having 'passed' the test, all or at least the length and breadth LSI values must have displayed statisitcal significance. Those sites for which more than one proportion did not display statisitcal significance are marked as "reject", meaning that we must reject the null hypothesis. Those sites for which there were no somples or only one or two samples for statisitcal significance in the size and shape of sheep on the basis of their LSI values according to proportions are marked as "accept", each proportional comparison, and therefore where it was impossible to perform a comparison, are marked as n/a for 'not applicable'.



Figure 8.8: Graph of bivariate comparison of measures of length (GLl) and breadth (Bd) of *Ovis aries* astragali from indigenous (red) and colony sites (blue) of southern Italy. Measures given in mm.

southern Italian sites. Monte Irsi can also be seen in this figure, sitting neatly between the shape fields for Greek and earlier indigenous sites. Unfortunately, having only two measures does not allow us to make firm conclusions about the nature of sheep from Pomarico Vecchio, or from Monte Irsi. In order to expand our dataset these sheep data must be translated into proportional LSI values.

LSI analysis of data from *Ovis aries* shows a continuation of trends seen in the raw bivariate data. Data points from colony sites of southern Italy and Sicily are situated within the shape distribution for Greek taxa and are distinct from that of the earlier indigenous sites. Data points from Pomarico Vecchio sit firmly within the shape distribution for Greek and colonial sheep. The site of Incoronata, which for *Bos taurus* demonstrated a middle ground shape distribution between colonial and earlier indigenous sheep, sits for *Ovis aries* firmly within the shape distribution for earlier indigenous sites as can be seen in Figures 8.12 and 8.13.



Figure 8.9: Graph of bivariate comparison of raw measures of distal breadth (Bd) and depth (Dd) of tibia for *Ovis aries*. Markers illustrate measures for sites of Greece (green), indigenous sites of southern Italy (red) and colony sites of southern Italy (blue). Measures given in mm.

The correspondence between 'colony' sites and those of Greece indicates that sheep in these colony sites of southern Italy were relocated. The height estimates, univariate and bivariate analyses and now data from LSI bivariate analyses all argue for the same conclusion. Colony sites in southern Italy contain for the most part the same enlarged sheep (*vis a vis* pre-colonisation indigenous sites of the region) which can be argued to be of the Greek variety based on their size and shape. As with *Bos taurus*, the shape distributions for the colony sites do not overlap exactly with those of Greek sites. Thus it is entirely likely that the sheep herds of these sites contained either parallel groups of Greek and a small amount of indigenous sheep (either traded for live or as meat) or that interbreeding occurred to some degree between the varieties without causing significant changes in the shape of colonial sheep. As for the site of Incoronata, shape field data from the above figures are not suggestive of the shape distribution of Greek sheep. The few data available for sheep from Incoronata seem to indicate that indigenous varieties of sheep were kept at the site. With regards to Pomarico Vecchioi, Roccagloriosa and Monte Irsi, their placements within the bounds of the shape distribution for Greek/colony sheep suggests either significant trade for sheep of the Greek variety


Figure 8.10: Graph of bivariate comparison of raw measures of distal breadth (Bd) and depth (Dd) of tibia for *Ovis aries*. Markers illustrate measures for indigenous sites (red) and colony sites (blue) of southern Italy. Measures given in mm.

(alive or dead), or that the herds of this site were interbreeding with sheep of the nearby colonies (for map see Figure 6.2). As with cattle, it is also possible that a mixed variety of Greek and indigenous sheep (in any proportions of mixture) was specifically 'improved' by Greek colonists to increase the height and robusticity of the animals. As was mentioned for cattle, it is considered here to be unlikely that Greek 'improvement' would have been carried out at all colonies specifically in order to duplicate the size and shape of Greek varieties through improvements to indigenous or mixed variety sheep. As these colony sheep correspond closely to those of Greek sites (see Appendices C and D for more graphs and statistics) it is argued here that this indicates the translocation of livestock from Greece to colony sites.

Following from these observations obtained from bivariate graphs of raw and LSI data, it is necessary to subject our evidence to statistical inquiry. The Greek nature of sheep in colony sites of southern Italy, as well as of Incoronata, Monte Irsi, Pomarico Vecchioi and Roccagloriosa was subjected to a series of Mann-Whitney U tests to determine if each group could demonstrate a population shape similarity with the previously identified Greek variety of sheep. These results, shown in Table 8.2 and Appendix D, correspond well to the findings of the visual assessment of the figures given below. Sheep from colony sites are not only visually but statistically of the same variety as those of Greece. The later period indigenous sites of southern Italy also had statistically significant similarities between the sheep biometry of these sites and those of Greece. These later period sites did not display a statistically significant similarity to sheep of earlier period indigenous sites. Although the small sample sizes for sheep of these later indigenous sites make the Mann-Whitney U test less accurate, these similarities, coupled with the statistical significance between these sheep and colony sites reinforce that the visual impressions of similarity between sheep of these later period indigenous sites and those of the Greek variety. While the shape distributions of these sheep do not indicate a wholly Greek variety, there is strong evidence from these data for mixing of Greek and indigenous sheep at these sites.

With regards to evidence for the translocation of *Capra hircus* and *Sus domesticus* from Greece to colony sites in Italy, LSI data from these taxa are shown below in Figures 8.14 and 8.15. As can be plainly seen, no variation by category of site can be discerned even with the enlarged sample sizes of LSI values. It is then not possible to distinguish regional varieties of *Sus* or *Capra* in this study, whether due to meagre sample sizes (*Capra*) or total lack of regional shape variation (*Sus*). These data are therefore inconclusive and cannot contribute to our understanding of Greek colonisation in this area at present.

Eraclea	Lucana		accept		accept	accept		accept				accept	reject	accept	accept	accept		reject				accept			
Pantanello	Sanctu-	ary	accept		accept	accept		accept				accept	reject	accept	accept	accept		accept	accept			I		accept	
Locri	Epizephiri		accept		reject	accept		accept				accept								I					
Kaulonia			accept		accept	accept		accept				accept	accept					accept	I					accept	
Lentini			accept		accept	accept		accept				accept	accept	accept	accept	reject			accept			accept		accept	
Pomarico	Vecchio		accept		accept	accept		accept				accept	reject	accept	accept			reject				accept		accept	
Roccagloriosa			accept		accept	accept		accept				accept	reject	accept	1	accept		accept				accept		accept	
Monte	Irsi		accept		accept	accept		accept				accept	accept	1	accept	accept		accept				accept		accept	
Incoronata			accept		accept	reject		accept				reject		accept	reject	reject		reject	accept			reject		reject	
Kassope			accept		accept	accept		accept				1	reject	accept	accept	accept		accept	accept			accept		accept	
Poseidon	a Tenos									ı															
Kabiren	bei	Theben	accept		accept	accept						accept	accept	accept	accept	accept		accept	accept			accept		accept	
Herakleion	de Thasos		accept		accept	I		accept				accept	reject	accept	accept	accept		accept	accept			accept		accept	
Kastanas			accept		I	accept		accept				accept	accept	accept	accept	accept		accept	accept			accept		accept	
Artemision	Olympia				accept	accept		accept				accept	accept	accept	accept	accept		accept	accept			accept		accept	
Site			Artemision	Olympia	Kastanas	Herakleion de	Thasos	Kabiren bei	Theben	Poseidon a	Tenos*	Kassope	Incroronata	Monte Irsi*	Roccagloriosa	Pomarico Vec-	chio	Lentini	Kaulonia	Locri	Epizephiri*	Pantanello	Sanctuary*	Eraclea Lucana	

considered. Those sites for which there is a statisitcal significance in the size and shape of sheep on the basis of their LSI values display statisitcal significance are marked as "reject", meaning that we must reject the null hypothesis. Those sites for which there are not enough samples for a rigorous run of the Mann-Whitney U test (e.g. fewer than five) are marked with an asterisk. Those for which there were no samples or only one or two samples for each proportional comparison, and therefore where it was impossible to perform a Sites marked with an asterisk contained extremely low sample sizes (less than five) and should therefore be only hesitantly the same size and shape variety. In order for a comparison between two sites to be considered as having 'passed' the test, all or at least Table 8.2: Results of Mann-Whitney U tests for LSI values of *Ovis aries* from Greek sites and indigenous and colony sites of southern according to proportions are marked as "accept", meaning that we accept the null hypothesis that the sheep from these sites come from the length and breadth LSI values must have displayed statisitcal significance. Those sites for which more than one proportion did not comparison, have been left blank. Italy.



Figure 8.11: Log Size Index Comparison of length (Gl) and proximal breadth (Bp) of all elements for Ovis aries from Greek and southern Italian indigenous and colony Sites. Values have been multiplied by 100 for ease of display. Markers are colour coded by site category. Mean values are illustrated with crosshairs showing one standard deviation.



southern Italian sites. Values have been multiplied by 100 for ease of display. Markers are colour coded by site category. Mean values Figure 8.12: Log size index (LSI) comparison of length (Gl) and proximal breadth (Bp) of all elements for Ovis aries from Greek and are illustrated with crosshairs showing one standard deviation.



southern Italian sites. Values have been multiplied by 100 for ease of display. Markers are colour coded by site category. Mean values are illustrated with crosshairs showing one standard deviation. A graph showing all values for proximal breadth and depth of Ovis aries Figure 8.13: Log size index (LSI) comparison of proximal breadth (Bp) and depth (Dp) of all elements for Ovis aries from Greek and elements is given in Figure C.20 of appendix C.



Figure 8.14: Comparison of LSI values for length (Gl) and proximal breadth(Bp) of Capra hircus from Greek and southern Italian sites. Values have been multiplied by 100 for ease of display. Markers are colour coded by site category.



Figure 8.15: Comparison of LSI values for length(Gl) and proximal breadth(Bp) of Sus domesticus from Greek and southern Italian sites. Values have been multiplied by 100 for ease of display. Markers are colour coded by site category. Mean values are illustrated with crosshairs showing one standard deviation.

8.2 Domesticates, Translocation and Central Dalmatia

For sites in Dalmatia, few measures are available for Bos taurus. From a graph of only those few Bos measures available from Dalmatian sites there is some indication that animals from the site of Resnik are of a larger size than those of the other sites in the area, as can be seen in Figure 8.17. From this same figure, though, it also appears that cattle from the historically known Greek colony of Pharos are the smallest of the region's cattle. As mentioned above, it is impossible to make conclusions as to the size and shape of a domesticate population based on the measures of only one or two individuals. However, when those few data points are plotted in comparison with both one another and with Greek sites is is apparent that the measures from indigenous sites of Dalmatia are distinctly smaller than those of Greek sites. For measures of the astragalus (Figure 8.16) all Dalmatian measures are situated to the smaller (shorter in stature) and more gracile end of the Greek shape distribution. For other elements, however, the site of Resnik sits more squarely within the shape field for Greek sites. The historically known colony of Pharos (in contrast with Resnik and the colonies of southern Italy) does not contain data points within the shape distribution for Greek cattle. Given the ever-present plague of small sample sizes, these indications for colonies of Dalmatia cannot be securely considered indicative of Greek versus non-Greek cattle at the sites in question.

With regards to data from Dalmatia, the use of LSI expands the data set, but not drastically. Cattle remains are still uncommon enough (by contrast to sheep) on these sites that even with LSI expansion of the data set it is difficult to visually asses concrete interpretations. However, the previous indications of cattle from Resnik as being larger than those of Gradina Rat and Pharos remain, with the added indication that this increase is one of size (bone length) rather than also of robusticity (element breadth). This is particularly the case for Resnik. Figure 8.20 shows a comparison of the LSI values for breadth and depth of elements from Greek and Dalmatian sites and strongly suggests that the only site from Dalmatia which could be considered to have Greek livestock is that of Resnik. However, this LSI of robusticity has only two points for Resnik, which is not a large enough dataset to make definitive claims. It is of interest here, however, that the scattered breadth seen with increase in length in Figure 8.19 is not apparent in those elements for which measures of breadth and depth were available. It may be the case that cattle at this site were



Figure 8.16: Graphical comparison of measures of length (GLl) and breadth (Bd) of astragalus for *Bos taurus* from sites of Greece and central Dalmatia. Site markers are colour coded by site category. Measures are given in mm.

originally of the indigenous variety, which was eiither mixed with translocated Greek livestock or bred for increased stature. With the current meagre data set this theory cannot be tested. Therefore, we may only determine that cattle of Resnik demonstrate clear signs of variation from those cattle of the other sites considered for central Dalmatia, and that this variation resembles somewhat that of Greek cattle. Cattle from Pharos also show some indications of a variety of increased stature, although less distinctly than for Resnik and also through an inadequately small sample size.



Figure 8.17: Graphical comparison of measures of length (GLl) and depth (Dl) of astragalus for *Bos taurus* from sites of Greece and central Dalmatia. Site markers are colour coded by site category. Measures are given in mm.



Figure 8.18: Graphical comparison of measures of length (Glpe) and breadth (Bd) first phalanx for *Bos taurus* from sites of Greece and central Dalmatia. Site markers are colour coded by site category. Measures are given in mm.



Figure 8.19: Plot of LSI indices of length (Gl) and proximal breadth (Bp) for Bos taurus of sites of Greece and central Dalmatia. Mean LSIs are given with crosshairs to illustrate one standard deviation. Markers are colour coded by site category. For ease of display LSI values have been multiplied by 100.





Comparisons of measures for *Ovis aries* from sites in Dalmatia show some differentiation into two categories of site. The separation between indigenous and colony sites is not as clear for Dalmatian sheep as for those from southern Italy, but there is a differentiation between measures from the indigenous settlement of Gradina Rat (both from Late Bronze and Iron Age layers) towards the lower end of the shape field and the later Hellenistic site of Spila Nakovana and the colony of Resnik towards the upper end of the field (although this does not appear as consistently for all elements). When these measures are overlaid upon those of Greek sites we can see a similar difference between the Dalmatian sites as was indicated for *Bos* (Figures 8.21 and 8.22). Samples from Gradina Rat and Pharos sit distinctly towards the smaller and more gracile end of the Greek shape distribution with Resnik and Spila Nakovana visibly larger and more robust. Unlike for *Bos*, shape samples for *Ovis* do not cluster neatly at the very edge of the Greek shape distribution but rather display differences between sites within the overall Greek shape. This is similar to the dispersion of mean values for indigenous sites of southern Italy, and suggests that in both areas indigenous sheep were not of as uniform a variety (or varieties) as those from Greece.

When the sample sizes of *Ovis aries* from Dalmatian sites are expanded as proportional LSI values, more detail on their shape fields can be deduced. The indigenous sites of Gradina Rat and Spila Nakovana, though widely spread (particularly for Spila Nakovana) can be seen via their mean LSI values in Figures 8.23 and 8.24. The colony site of Pharos sits slightly apart from the indigenous sites in its shape distribution, within it but not at its centre. The centre of the shape distribution (as well as roughly half of its points) were confined within the central shape for indigenous Dalmatian sheep. The remaining three points, while still within the wider shape distribution for Dalmatian sheep, overlap with the distribution of sheep from Greek sites as seen in Figure 8.23. From the distribution of data points for Pharos, it appears on the basis of overall length (GL), proximal breadth (Bp) and depth (Dp) that the sheep of this site were of the indigenous variety. The colony of Resnik sits in both its field and its centre well within the shape field for sheep from Greek sites. The exception to this was a single data point which sat within the centre of Dalmatian indigenous sheep data, as seen most clearly in Figure 8.23.

From these data for both raw measures and LSI values we can see that sheep from indigenous sites of central Dalmatia exhibit a greater range of variation in size and shape (between sites) than do those of Greek sites, as can also be seen for indigenous sites of southern Italy. It should be noted



Figure 8.21: Comparison of measures of distal breadth (Bd) and depth (Dd) of tibia of *Ovis aries* from sites of Greece and central Dalmatia. Markers are colour coded by site category. Measures given in mm.

that this wide spread of shape field is seen not only in the later site of Spila Nakovana and the Iron Age layers of Gradina Rat but also in the Late Bronze Age layers of Gradina Rat, which is securely before the period of colonisation in this region. The particularly wide spread of shape for *Ovis aries* of the site of Spila Nakovana gives some suggestion that it, as with Pomarico Vecchio may have seen some mixing of Greek and indigenous sheep varieties. However, even when expanded with LSI the sample size is not robust enough to deduce this from visual comparisons alone. In order to determine the significance of these visual data, Mann-Whitney U tests were performed on *Ovis aries* data from these sites against not only one another but those of Greece. The results of these tests are given in Table 8.3 as well as in Appendix D. From these tests we can see a clearly significant pattern of Greek sheep at the colony site of Resnik, as well as some indications of Greek sheep at Pharos. The sheep from Pharos, however, do not display the same uniform significance seen for Resnik; neither are they significant when compared to sheep of indigenous sites. While it



Figure 8.22: Comparison of measures of length (GLl) and breadth (Bd) of astragalus of *Ovis aries* from sites of Greece and central Dalmatia. Markers are colour coded by site category. Measures given in mm.

is possible that this site contains Greek sheep, the combined graphical and statistical data are not suggestive of a wholely Greek variety. The data indicate, rather, that sheep at Pharos were of a mixed variety or population, analogous to the later-period indigenous sites of southern Italy. The indigenous sites of central Dalmatia, both from pre- and post-colonisation periods, do not indicate change in the size or shape of sheep with colonisation in this area.



Figure 8.23: Summary of mean LSI comparisons of length (Gl) and proximal breadth (Bp) indices for Ovis aries from sites of Greece and central Dalmatia. Markers colour coded by site category. Crosshairs indicate one standard deviation from the mean.



Figure 8.24: Summary of mean LSI comparisons of proximal breadth (Bp) and depth (Dp) indices for Ovis aries from sites of Greece and central Dalmatia. Markers colour coded by site category. Crosshairs indicate one standard deviation from the mean.



Figure 8.25: Summary of LSI comparisons of distal breadth (Bd) and depth (Dd) indices for Ovis aries from sites of Greece and central Dalmatia. Markers colour coded by site category. Crosshairs indicate one standard deviation from the mean.

	_		_									_	
Resnik		accept	accept	accept	accept		accept		accept	accept	accept	reject	1
Pharos		reject	reject	reject	reject		accept		reject	reject	reject	ı	accept
Spila	Nakovana	reject	reject	reject	reject		reject		accept	accept	I	reject	accept
Gradina	Rat IA	reject	reject	reject	reject		reject		accept	1	accept	reject	accept
Gradina	Rat LBA	reject	reject	reject	reject		reject			accept	accept	reject	accept
Škrip*								1					
Kassope		accept	accept	accept	accept		I		reject	reject	reject	accept	accept
Poseidon	a Tenos*					I							
Herakleion	de Thasos	accept	accept	accept	ı		accept		reject	reject	reject	reject	accept
Kabiren bei	Theben	accept	accept	I	accept		accept		reject	reject	reject	reject	accept
Kastanas		accept	I	accept	accept		accept		reject	reject	reject	reject	accept
Artemision	Olympia	I	accept	accept	accept		accept		reject	reject	reject	reject	accept
Site		Artemision Olympia	Kastanas	Kabiren bei Theben	Herakleion de Thasos	Poseidon a Tenos*	Kassope	Škrip *	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana	Pharos	Resnik

Table 8.3: Results of Mann-Whitney U tests performed on LSI values for Ovis aries from sites in Greece and central Dalmatia. The
number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available were
subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Any site
with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis
for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values
have been highlighted. Those sites for which no test was run (as between a southern Italian Greek colony and a Dalmatian indigenous
site) are marked with an asterisk (*).

8.3 Summary of Findings

With regards to an understanding of the process of Greek colonisation in Magna Graecia and central Dalmatia, it can be seen from the faunal data that colony sites can (with the exception of Pharos) be distinguished on the basis of their domesticate (sheep and cattle) biometry. This indicates, as seen in both visual and statistical assessments, that animals from Greece were translocated to these colony sites. The presence of livestock of mixed variety at the site of Incoronata and later indigenous sites of Monte Irsi, Roccagloriosa and Pomarico Vecchio not only argues against full 'hellenization' in Magna Graecia but also serves to counter-act the argument of Incoronata as a Greek colony. A site with pre-colonisation indigenous occupation layers, mixed Greek architecture and material culture - including the domesticated animals, is here taken as indicative of interaction with nearby Greek colonies (most notably that of Metapontum, which is nearest) but only selected adoption of material culture (i.e. cattle and not sheep) rather than wholesale replacement. In this way Incoronata is an example of 'creolization' or 'hybridity' in the colonial environment. The sites of Roccagloriosa and Pomarico Vecchio, being of varying distances from colonies but of roughly the same late Classical/earlier Hellenistic period in their faunal samples (c.fourth century BC), both show signs of intermingling of livestock with Greek varieties. This intermingling of varieties, as with Incoronata, provides good evidence of interaction between colonists and indigenous groups in the colonial environment. The slight variation at Greek colonies of Magna Graecia in the shape of livestock, while still overwhelmingly Greek, provides new implications. While our understanding of the domesticate biometric varieties in indigenous southern Italy and from Greek sites of the Archaic and Classical periods are still limited, a further enlargement of the data sets for both of these areas, as well as more detailed studies of these colonies and their immediate indigenous vicinities may well show a minor component of indigenous livestock varieties within the Greek herds. From the present data, this cannot be conclusively argued, but provides a thought for future inquiry into Greek colonisation of this area.

From this it is inferred that the level of state organization - and from this the level of presumed organization in the colonial foundation - had little impact on the structure of the material culture of the colony. For the colonies of Magna Graecia sampled, their Archaic period foundation and the lack of state organization seen from the later development of the polis would suggest that the foundation of these colonies was not a large-scale state organized affair but rather the relocation of individuals, families or small groups from various parts of Greece. The identified similarity of domestic sheep and cattle in these colonies to those of mainland Greece at the time does not settle the argument for or against the organized nature of Archaic colonisation, but rather precludes it. The state of organization in colonial foundation, as seen by Greek taxa in the Greek colonies, argues that even the movement of small, self-organized groups of individuals (argued for in the Archaic period) allowed for the transference and maintenance of Greek material culture and its organization in the new colonial environment. Despite the disparate regions and disorganized process of colonisation argued for the Archaic period, the domesticate biometry at these colony sites argue that they were settled by Greeks and ostensibly as 'Greek' colonies, despite a lack of 'official' or polis organization in their foundations. The presence of Greek livestock at the Hellenistic colony of Resnik on the Dalmatian coast also shows the movement and maintenance of Greek material culture in this later and presumably state-organized colony.

The lack of firm identification of Greek livestock at the Hellenistic colony of Pharos (in central Dalmatia) provides us with new and different insights into the colonisation process. The presence of indigenous (or mixed) livestock at the colony of Pharos, as well as the lack of good evidence for change in local indigenous Dalmatian livestock with colonisation indicate that not all Greek colonies followed the same process in their foundation and development. Whether Greek livestock were initially translocated to Pharos and then subsumed by indigenous varieties cannot be ascertained from the present data. The example of Pharos, however, still provides the best evidence from this study against the traditional view of Greek colonisation as 'hellenization'.

It is instead suggested that what are thought of from historical sources as Greek colonies were not necessarily uniform in their domesticate varieties (much the same way as with other varieties of material culture). Not all colonies contained (or continued to maintain) Greek livestock varieties, and those which did seem to have made their own subtle variations in variety shape or composition. The domesticate biometry of Greek colonies, as well as all other sites in the areas of colonisation, should therefore be examined alongside other artefacts of material culture. Given the arguments in Chapters 3 and 4 for the nature of Archaic Greece and Greek colonisation, it was never anticipated in this study that colony sites would display as much evidence for the translocation of Greek domesticates. The potential motivations for the specific relocation of Greek livestock (as opposed to those varieties available locally) deserve further examination in a later study. The case of Pharos suggests also that this domesticate translocaton was not necessarily a standard feature of Greek colonisation in all areas of the Mediterranean and Pontic regions. Additional studies of domesticate variety translocation looking at other areas of Greek colonisation can serve only to aid our understanding in this area.

Chapter 9

Summary and Conclusions: A Zooarchaeology of Greek Colonisation

In this study two main research questions were addressed. The first and primary research question was to determine whether or not cultural and/or regional varieties of domesticated animals could be identified in the archaeological record using biometrical analysis. That is to say, to determine if the remains of domestic animals found in archaeological contexts could be distinguished by region/culture on the basis of their size and shape. This was done by comparing biometric data of sites from Greece against one another, and also against indigenous sites in the study areas. The second question addressed was how regional or cultural variation in faunal remains of domesticates could add to our understanding of Greek colonisation. It was argued in Chapter 3 that earlier colonisation such as that of Magna Graecia, largely occurring over the Archaic Period, would have not been state-sponsored and organized as the state formations of the polis were not believed to have been in place at this time. It was argued that the cultural changes in Greece caused by the Persian and Peloponnesian wars caused changes in the way in which Greeks were organized, as well as how they conceptualized themselves and others.

In order to test these major research questions, it was necessary first to gain a good background understanding of the state of archaeological understanding in the three main research areas. For this a background of contacts and settlement evidence was given for Greece, the eastern Adriatic and southern Italy/Sicily from the Late Bronze Age to the Hellenistic Period (*c*.1400-200 BC). This was given in Chapter 2, with special attention paid to evidence for pre-colonisation contacts along the eastern Adriatic and southern Italy/Sicily. A discussion of the timing, locations, and process of colonisation in these study areas was also given. As we have seen, evidence from the Late Bronze

Age onwards points to trade contacts, most likely on a small scale but possibly more intensive, between Greece and the regions of the Adriatic and southern Italy. With the onset of the Archaic period and the spreading of colonies outside of Greece along the southeastern Adriatic coast and the Ionian coast of southern Italy, evidence for trade intensifies. The spreading of colonisation and increased contacts with these regions in the Archaic period brought indigenous groups at least of southern Italy into increased (and in some cases sustained) contact with hellenic peoples.

In order to understand Greece in this period, a discussion was given in Chapter 3 on 'being Greek' in the Archaic and Classical periods. This focused primarily on the state of polis formation and the development of panhellenic centres in Greece. Following this a discussion was given of the Persian and Peloponnesian Wars, and their impact on later hellenic society. It was argued that these two wars, encompassing nearly a century of Greek history, altered the outlook and identity of Greece and Greek culture. There was a greater political entanglement between poleis than was seen in earlier periods, and a greater suspicion of non-Greeks or 'barbarians' than could be argued for the Archaic and earlier Classical periods. As to the level of organization involved in this colonisation it has been previously argued by myself and others that the polis-state and its organization did not develop until after the Archaic colonisation process was underway. From the increased polis-state development and political complexity from the Archaic to Hellenistic periods in Greece, the argument was made that increased state development in Greek poleis and the wars of the fifth century BC would have led to a more organized process of colonisation in central Dalmatia. It was also hypothesized that this increased organization would be apparent in the movement of livestock with colonists into areas of colonisation.

Chapter 4 tackled the problem of colonisation. Any study of colonies or colonisation needs to consider the complicated framework for investigating this form of cultural contact and human movement. It was argued in this chapter that colonisation is not so much a theoretical line of inquiry but a complicated mosaic of differing inquiries for different cultures and periods, each of which needed to be examined separately. The variation in colonies and colonisation processes in both the historical and archaeological record requires that any understanding of colonisation as a process must first and foremost investigate specific incidences of colonisation. Specific colonies and their impact upon or by their setting must be considered first. Following from this a consideration must be made of the process of colonisation for a given culture, taking into account several if not all of the

colonies from that culture which can be identified, and consider them in their setting in comparison with one another. Only then can any general points be highlighted to examine in comparison with previously examined colonisation processes of another culture. For the purposes of this study, the Greek colonisation of Magna Graecia and central Dalmatia were highlighted as they occurred in different areas and periods, and allowed for a prime arena in which to examine cultural variation of domesticates and the movement of livestock. The importance of livestock as material culture was addressed in Chapter 5, where it was argued that varieties of domesticates, as the by-products of human management strategies and desires, form a category of material culture (in the patterning of their size and shape). Through the management of domesticated animals both in control over their lifespans and breeding patterns as well as any desires for manageability, secondary products or other characteristics, the cultures which keep breeding groups of domestic animals over time shape the animals in question. It was argued that the wider implementation of biometrical meta-assessments of domesticated animals from the Neolithic up to and through the Roman and Medieval periods would allow for a greater understanding of the role of livestock in archaeological cultures, as well as the scale and nature of contact between and within prehistoric and historic cultures studied by archaeology.

This brought us back to the first research question, that of the identification of cultural and/or regional varieties of domestic animals. Chapter 6 detailed the sites selected for the study, as well as the techniques used in the recording, selection and analysis of faunal materials and the biometric data they provided. A description of the sites used in the study was given, along with maps of their locations and dates of occupation to which the faunal assemblages related. The first and primary research question (the identification of cultural/regional varieties of domesticates) was addressed in Chapter 7. The taxonomic ratios and age profiles of the sites in the study were examined to determine if these more traditional techniques of zooarchaeological inquiry gave any indications of patterning by culture or area. When it was determined that these were insufficient, the biometric data for Greek and indigenous sites were examined. Beginning with the most basic biometrical techniques, a comparison was made between Greek, indigenous and colony sites of the study areas on the basis of height estimates (WRH) calculated from complete bone lengths. Some indications were given for differentiation in height between Greek and non-Greek varieties of sheep (*Ovis aries*) and cattle (*Bos taurus*). Indications were not, however, strong enough to argue for cultural

variation on the basis of height alone. Further examination was made of biometric data on the basis of measures in three dimensions (length, breadth and depth) of elements. A regional variety of Greek livestock was identified by its size and shape. For cattle (*Bos taurus*) this variety was not visible in the far north at the Macedonian site of Kastanas, but was visible from other sites of Greece from the earlier Classical period. For sheep (*Ovis aries*) this regional Greek variety was identifiable from Greece (and Kastanas in Macedonia) from as early as the Archaic period. It was also shown that pre-colonisation indigenous sites of both central Dalmatia and southern Italy could be distinguished from these Greek domesticates.

The question of the movement with domesticates in colonisation was addressed in Chapter 8. A comparison of bivariate or multi-dimensional analysis of measures was made for both raw measurements taken from bones and the converted Log Standard Index or LSI values. Surprisingly, the most uniform evidence for the translocation of livestock came not from colonies of central Dalmatia but from those of southern Italy. Given the arguments considered in this study, the increased state formation of the polis over the Classical and Hellenistic periods should have been visible in a greater level of organisation (and presumably domesticate translocation) at later (Hellenistic) colonies than the earlier (Archaic) settlement of Magna Graecia. This was found not to be the case. Also surprising was that, while colony sites of southern Italy demonstrated the presence and therefore translocation of Greek taxa, many colonies also demonstrated faint but consistent (across colonies) evidence for the intermixing of indigenous and domestic varieties. Later period, postcolonisation sites demonstrated evidence for the intermingling of Greek taxa of either Bos taurus or Ovis aries, although not always for both at the same site. Why this might be so deserves further study, as the small number of sites and sample sizes in this area of inquiry does not allow for a full understanding of the process of domesticate intermingling, or the discrimination between multiple varieties present at the same site. This spread of Greek and indigenous domesticate varieties, however, strongly suggests contacts between Greek colonies and indigenous settlements, with each acquiring animals from the other of a type and to a degree pleasing to them. There is no evidence for the wholesale imposition of Greek material culture - domesticates - upon indigenous sites in the areas of colonisation. Neither is there evidence for the wholesale relocation of 'hellenic' culture - again domesticates - by Greeks into their colonies. This mixing of varieties of domesticates is yet another example of colonial material culture. As with the spread of ceramics, wine drinking paraphernalia and other goods, domestic animals were likely moved or interbred between sites by the selective desires of the humans who kept them.

Were it not for the evidence from Dalmatia, it could be argued that these colonial data of southern Italy are indicative of the fluid identities and low xenophobia of Archaic period Greeks (in the indications for mingling of indigenous domesticates at these sites). The colonies of Pharos and Resnik, both Hellenistic in their foundation, demonstrate vastly different domesticate profiles. Whereas the colony of Resnik demonstrates Greek cattle and sheep with only some evidence for intermixing of livestock, the colony of Pharos (only approximately one century older) does not contain demonstrably Greek domesticates in its sample. Both the Bos taurus and Ovis aries biometric data of this site demonstrate a pattern that is neither wholly Greek or indigenous, but sits much nearer to the local indigenous domesticate varieties than the Greek. Evidence for the intermingling of varieties at both sites is difficult to quantify, as the variation in size and shape for central Dalmatian taxa (as noted above) is difficult to quantify reliably with the small number of sites in the sample. However, when compared both in their shape distributions and means, Resnik contains Greek domesticates and Pharos indigenous ones. Both were likely intermingled with those of indigenous varieties, but in the mean belonged to these groups. It is surprising that, in a time of increased political and state complexity, a historically identified Greek colony contains less evidence for organized hellenic colonisation in domesticate translocation. No argument can be made for Pharos that Dalmatian sheep and cattle may have been considered in some way superior to the Greek variety by colonists, for they were taken to Resnik and kept there.

As can be seen from this study, it was not the timing of colonisation that was important in the hellenic material culture of a colony or its environs, but its context and the people in it. What we have discovered in this study is not only the diversity of experiences of Greek colonisation, but also evidence for standard organisation. While not all Greek colonies translocated Greek livestock, those that did did not maintain them in a vacuum.

The data obtained from this study have broad implications for both the study of domesticated animals and the study of colonisation. It has been shown clearly that it is possible through biometric data to identify cultural and/or regional varieties of domesticated animals. This means that specific and intensive breeding of livestock such as seen in recent centuries is not a necessary prerequisite for the development of culturally or regionally specific varieties of domesticated animals. While the findings from the biometric data cannot be used to argue either for or against any specific and intentional breeding for form or function on the part of ancient Greeks, Dalmatians or Italians, variations do exist in these areas in the size and shape of the domesticated animals. Therefore, the intensive or selective nature of breeding (or knowledge of it) is not necessarily required in a site, region or culture in order to identify domesticate varieties in the archaeological record. Now that it has been shown that a comparative assessment of domesticate biometry can identify regional or cultural domesticate varieties, this can be examined in any area or archaeological culture for which there are domesticated animals. An obvious example was given in this study - that of colonisation.

The translocation of livestock in Greek colonisation need not only be studied in Greek colonies of these area, nor in Greek colonisation. Greek colonies in other areas of the Mediterranean, Near East or Pontic Regions can be examined to determine if domesticates were translocated to those areas. Indigenous sites in these areas can then be compared with local colonies and Greek sites to determine if there is similar evidence for the interbreeding or trading of livestock in the colonial environment. Aside from Greek colonisation, other archaeological studies of colonisation could employ this technique to determine if other archaeological cultures contained distinguishable varieties of domesticates, and if these too can be seen to be translocated with colonisation. Aside from studies of colonisation and colonial interactions, the identification of cultural/regional domesticate varieties could be employed for any archaeological culture for which there are questions of interaction or uniformity across an area, or of interactions and contacts between neighbouring cultures.

Future work in both the study of regional/cultural varieties of domesticates and of faunal translocation in colonisation should keep in mind the strengths and weaknesses of this project. A major strength of this study has been the use of biometric data. This category of data is often taken during faunal analysis even though it is not often used. Such data are obtainable from first-hand analysis, published material or from polite enquiries to the analyst of the faunal assemblage. Faunal material is often also the second most prevalent category of finds from an archaeological excavation (after ceramics) and in some cases is even the most prevalent find category (Crabtree 1990:155). The remains of domesticated animals are usually the most prevalent group within faunal material (for sites of the Neolithic onwards), and so are a large category of data which can be pushed to new informational boundaries using this technique. This study is also in many ways

its own strength. It is the first for its area which models changes in faunal data and translocation of livestock to study (Greek) colonial interactions. It also has shown that cultural and regional varieties of domesticates are identifiable given a detailed assessment. The approach of two major research questions embedded within one another allows for this study to be of great utility not only to zooarchaeologists but also to classical archaeologists and archaeologists working in other fields.

On the downside, a thorough understanding of the variety or varieties of livestock maintained by a given culture or region requires a large-scale sampling of domesticate biometry from many sites in the region and period. For this study only a small number of sites were available for each of the study areas. If time had not been an issue in this research, at least three times the number of sites for each area and period would have still been a very rough sampling of domesticate biometric variation in the areas. For ancient Greece in particular, as the foundation of identification of cultural biometric varieties, many more sites from the Archaic and Classical periods, covering the entire area of Greece would have provided a much firmer basis on which to rest the identification of Greek livestock. In the case of sheep (Ovis aries) the small number of sites available in this study was less problematic, as sheep biometry was significantly uniform in all sites sampled. However, other sites in Greece from these periods may have contained different varieties of sheep which went unnoticed here. Remains of cattle (Bos taurus) were more problematic, as they were less frequent and showed greater biometrical variation, particularly for the more northern (Macedonian) site of Kastanas. As a detailed understanding of the development and range of cultural varieties of Greek domesticates is still in its infancy, these shortcomings were acknowledged for this project and the available data were made the most of. Future studies in the area of regional/cultural domesticate varieties are still possible using limited numbers of sites - as was done here - but should be added to by future work until a clear and detailed picture of domesticate varieties, their development and movements can be gleaned from a given cultural area of region.

Another weakness in this study is that of teeth. Teeth mineralize in the jaw and erupt in their complete and final morphometric formation. They are therefore not subject to variations from their local environment over the life of the animal, save from trauma or pathology. A great failing in this study was the plastic nature of pig bones. A shortage of biometric data for pig teeth meant that no secondary study could be conducted to determine variation by region or culture for pigs. For the better represented sheep or cattle teeth, data also did not allow for good differentiation by

culture or area. This is because measures of teeth using conventional biometrical techniques allow only for secure measures of greatest length. Measures of greatest width can be taken, but the multianalyst nature of the sample from this study meant that reported or observed measures of width could not be used, as it was not always clear if measures of width (or even length in many cases) were taken at the occlusal surface or at the base of the enamel. Measures taken for teeth embedded within the jaw may also have varied from those of loose teeth, as within-jaw measurements are more difficult and can be less exact. Future studies of cultural domesticate varieties should address teeth (although separately from bones, for the reasons given above) but should use more detailed and accurate recording techniques such as geometric morphometrics (see below).

Future work could and should be conducted in this area along several lines. With regards to an understanding of the process of Greek colonisation in Magna Graecia and the eastern Adriatic, a more detailed investigation of domesticates of southern Italy has already been mentioned. In addition to this, domesticate varieties could be investigated at Corcyra (modern Corfu) and along the Albanian coastline of the eastern Adriatic at sites such as Apollonia and Epidamnus. Using the data from this study, other studies of material culture at colonies could be made looking at those artefacts which can move freely across distances (such as jewellery, ceramics or metalwork) as opposed to those which are more quietly indicative of Greek culture and do not travel well independently of humans, such as domesticates.

With regard to the identification of cultural varieties of domesticates, biometrical profiles should be created and the data shared among researchers so as to build up a database of biometric varieties by site, area, culture and period. In this way, alterations in livestock varieties and movements of varieties between sites and areas can be traced. To use the analogy from Chapter Five, ceramic chronologies would not be possible without the recording, reporting and collaboration of data from many sites and periods of both the same and different regions. In much the same way, the identification of the presence and development of cultural varieties of domesticated animals requires an ever increasing set of data to which to refer each new sample. In order to include a more detailed analysis of size and shape variation - both for bones and for teeth - the more common techniques of biometric recording should continue with the addition of data collection from geometric morphometrics.

Geometric morphometrics (GMM) is a computer-based statistical approach which compares

detailed measurements of the size and shape of a bone or tooth and the anatomical landmarks contained therein. This allows not only for precise measures in multiple planes but also a comparison of the relative locations of landmarks.¹ This technique would allow not only for the comparison of teeth on the basis of their landmarks, allowing for multiple measurements of size and shape variation within and between sites, but would also allow for the comparison of bone shape along additional planes. GMM requires one to be physically examining each bone processed into the dataset, as these have to be photographed in a standard manner to be comparable with one another. The development and spread of this technique in examining cultural varieties of domesticates would simply require the development of a standard set of photographs along set planes for the bones of domesticated animals. If photographs were standardized to the same rigorous degree as biometric measures are today, then photographic GMM data could form a component of the biometric/morphometric database for the study of regional and cultural domesticate varieties across time and space.

Once the practical components of data recording and sharing are considered, many areas of archaeology could benefit from this technique. More specific future directions for the identification of domesticate varieties could be the investigation of a larger and more detailed sample of indigenous sites from southern Italy so as to discern the exact reasoning for the slight variations between the predominately Greek taxa of colony sites in this area. In addition, sites from Greece in the Archaic and earlier periods could be examined to determine the area and timing of the development of the identified varieties of Greek livestock. This technique could be applied to other areas of Greek colonisation, for instance in the earlier foundations of settlements along the Aegean coast of modern-day Turkey, or in the Pontic region. A development of techniques similar to those used here could examine biometric and morphometric variation in horses which could help in identifying not only the timing and process of the domestication of *Equus caballus* but also its subsequent spread as a domesticate.² As stated before, the possibilities here are - if not endless - then at least very broad indeed.

¹Landmarks: points such as cusps of teeth or articular facets which can be realiably located on all specimens.

²Such a study has in fact very recently been conducted by K. Seetah, who was able to discriminate between horse variety populations on the basis of dental GMM (K. Seetah, personal communication).

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Appendix A

Site Taxonomic and Age Distributions

		Kastanas			Artem	ision Ol	ympia
Taxon	NISP	(%)	MNI		NISP	(%)	MNI
Bos taurus	1169	18.78	44		132	17.46	
OvisCapra	2016	32.38	112		590	78.04	
[Ovis aries]	[937]	[15.05]	[46]		[90]	11.9	
[Capra hircus]	[350]	[5.62]	[22]		[11]	1.46	
Sus domesticus	1871	30.05	109		27	3.57	
Canis familiaris	116	1.86	22		2	0.26	
Equus sp.	96	1.54	16		-	-	-
[Equus caballus]	[90]	[1.45]	[13]		-	-	-
[Equus asinus]	-	-	-		-	-	-
Gallus sp.	1	0.02	1		1	0.13	
Dama dama	443	7.12	27		-	-	-
Cervus elaphus	155	2.49	13		-	-	-
Capreolus capreolus	133	2.14	14		-	-	-
Lepus sp.	21	0.34	7		3	0.40	
Testudo sp.	-	-	-		-	-	-
Total	6226	-	-		756	-	-

Table A.1: Taxonomic distributions of Kastanas and Artemision Olympia.

	Kabir	en bei Tl	neben		Herak	eion de '	Thasos
Taxon	NISP	(%)	MNI		NISP	(%)	MNI
Bos taurus	530	13.17	20		130	23.42	9
OvisCapra	3238	80.49	125		434	78.2	30
[Ovis aries]	-	-	-		[33]	[5.95]	[15]
[Capra hircus]	-	-	-		[6]	[1.08]	[4]
Sus domesticus	47	1.17	7		21	3.78	6
Canis familiaris	3	0.07	2		-	-	-
Equus sp.	8	0.20	2		3	0.54	1
[Equus caballus]	-	-	-		-	-	-
[Equus asinus]	[5]	[0.12]	[2]		-	-	-
Gallus sp.	6	0.15	3		-	-	-
Dama dama	14	0.35	3		-	-	-
Cervus elaphus	69	1.72	5		-	-	-
Capreolus capreolus	25	0.62	2		-	-	-
Lepus sp.	36	0.89	9		-	-	-
Testudo sp.	12	0.30	5		-	-	-
Total	4023	-	-		555	-	-

Table A.2: Taxonomic distributions of Kabirenheiligtum bei Theben and Heraklein de Thasos.

]]	Kassope		Pose	idon a T	enos	
Taxon	NISP	(%)	MNI		NISP	(%)	MNI
Bos taurus	4885	17.16			167	60.07	24
OvisCapra	10400	36.54			34	12.23	5
[Ovis aries]	-	-	-		-	-	-
[Capra hircus]	-	-	-		-	-	-
Sus domesticus	7682	26.99			64	23.02	12
Canis familiaris	205	0.72			2	0.72	1
Equus sp.	575	2.02			-	-	-
[Equus caballus]	[73]	[0.26]			-	-	-
[Equus asinus]	[284]	[1.0]			-	-	-
Gallus sp.	316	1.11			-	-	-
Dama dama					-	-	-
Cervus elaphus	4022	14.13			-	-	-
Capreolus capreolus	271	0.95			-	-	-
Lepus sp.	101	0.35			-	-	-
Testudo sp.	47	0.17			-	-	-
Total	28462	-	-		278		

Table A.3: Taxonomic distributions of Kassope and Poseidon a Tenos.

	Tor	re Mord	illo			Termitito)		Coppa Nevigata		gata
Taxon	NISP	(%)	MNI		NISP	(%)	MNI		NISP	(%)	MNI
Bos taurus	287	26.45	-		148	21.39			2945	20.06	
OvisCapra	286	26.36	-		327	47.25			5806	39.55	
[Ovis aries]	-	-	-		[47]	[6.79]			[414]	[2.82]	
[Capra hircus]	-	-	-		[2]	[0.29]			[122]	[0.83]	
Sus domesticus	311	28.66	-		97	14.01			1592	10.84	
Canis familiaris	19	1.75	-		9	1.3			317	2.16	
Equus sp.	5	0.46	-		1	0.14			7	0.05	
[Equus caballus]	[5]	-	-		-	-	-		-	-	-
[Equus asinus]	-	-	-		[1]	[0.14]	1		[7]	[0.05]	
Gallus sp.	-	-	-		-	-	-		-	-	-
Dama dama	-	-	-		-	-	-		-	-	-
Cervus elaphus	84	7.74	-		31	4.48			1385	9.43	
Capreolus capreolus	-	-	-		1	0.14			150	1.02	
Lepus sp.	-	-	-		1	0.14			33	0.22	
Testudo sp.	83	7.65	-		70	10.12			1946	13.26	
Total	1085	-	-		692	-	-		14680	-	-

Table A.4: Taxonomic distributions of Torre Mordillo, Termitito and Coppa Nevigata.

	N	Ionte Irs	i	I	ncoronat	a
Taxon	NISP	(%)	MNI	NISP	(%)	MNI
Bos taurus	81	26.64		381	22.84	-
OvisCapra	147	48.36		664	39.81	-
[Ovis aries]	-	-	-	[55]	[3.30]	-
[Capra hircus]	-	-	-	[5]	[0.30]	-
Sus domesticus	67	22.03		524	31.42	-
Canis familiaris	-		-	14	0.84	-
Equus sp.	4	1.32		10	0.60	-
[Equus caballus]	-	-	-	[10]	[0.60]	-
[Equus asinus]	-	-	-	-	-	-
Gallus sp.	-	-	-	1	0.06	-
Dama dama	-	-	-	-	-	-
Cervus elaphus	2	0.66		53	3.18	-
Capreolus capreolus	-	-	-	1	0.06	-
Lepus sp.	-	-	-	2	0.12	-
Testudo sp.	1	0.33	1	-	-	-
Total	304	-	-	1668	-	-

Table A.5: Taxonomic distributions of Monte Irsi and Incoronata.

	Poma	rico Ve	ecchio		Ro	ccaglorio	osa
Taxon	NISP	(%)	MNI		NISP	(%)	MNI
Bos taurus	n/a	-	-		610	17.13	-
OvisCapra	n/a	-	-		807	22.66	-
[Ovis aries]	n/a	-	-		-	-	-
[Capra hircus]	n/a	-	-		-	-	-
Sus domesticus	n/a	-	-		281	7.89	-
Canis familiaris	-	-	-		23	0.65	-
Equus sp.	n/a	-	-		27	0.76	-
[Equus caballus]	-	-	-		[14]	[0.39]	-
[Equus asinus]	-	-	-		[13]	[0.36]	-
Gallus sp.		-	-		5	0.14	-
Dama dama	n/a	-	-		-	-	-
Cervus elaphus	n/a	-	-		11	0.31	-
Capreolus capreolus	n/a	-	-		-	-	-
Lepus sp.	n/a	-	-		-	-	-
Testudo sp.	-	-	-		16	0.45	-
Total	758	-	-		3562	-	-

Table A.6: Taxonomic distributions of Pomarico Vecchio and Roccagloriosa.

	Arch	aic Kaul	onia	Lentini			
Taxon	NISP	(%)	MNI	NISP	(%)	MNI	
Bos taurus	63	21.72	27	144	15.1	6	
OvisCapra	165	56.9	46	654	67.7	21	
[Ovis aries]	-	-	-	[67]	[7.04]	[5]	
[Capra hircus]	[5]	[1.72]	[2]	-	-	-	
Sus domesticus	43	14.83	24	130	13.6	11	
Canis familiaris	10	3.45	6	5	0.5	1	
Equus sp.	7	2.41	2	2	0.2	1	
[Equus caballus]	[6]	[2.07]	[1]	[2]	[0.21]	[1]	
[Equus asinus]	[1]	[0.34]	[1]	-	-	-	
Gallus sp.	-	-	-	-	-	-	
Dama dama	-	-	-	-	-	-	
Cervus elaphus	1	0.34	1	16	1.7	3	
Capreolus capreolus	-	-	-	-	-	-	
Lepus sp.	-	-	-	-	-	-	
Testudo sp.	1	0.34	1	-	-	-	
Total	290			952	-	-	

Table A.7: Taxonomic distributions of Archaic period Kaulonia and Lentini.

	Kaul	onia Clas	ssical	Panta	nello Sanc	tuary
Taxon	NISP	(%)	MNI	NISP	(%)	MNI
Bos taurus	97	37.74	38	553	46.62	
OvisCapra	121	47.08	45	227	19.14	
[Ovis aries]	-	-	-	-	-	-
[Capra hircus]	-	-	-	-	-	-
Sus domesticus	32	12.45	14	63	5.31	
Canis familiaris	6	2.33	2	38	3.20	
Equus sp.	1	0.39	1	156	13.15	
[Equus caballus]	-	-	-	[148]	[12.48]	-
[Equus asinus]	[1]	[0.39]	[1]	[5]	[0.42]	-
Gallus sp.	-	-	-	2	0.16	
Dama dama	-	-	-	4	0.34	-
Cervus elaphus	-	-	-	91	7.67	
Capreolus capreolus	-	-	-	2	0.16	
Lepus sp.	-	-	-	2	0.16	
Testudo sp.	-	-	-	19	1.60	
Total	257	-	-	1186	-	-

Table A.8: Taxonomic distributions of Classical period Kaulonia and the sanctuary at Pantanello.

	Locri	Epize	phiri	Era	clea Luc	ana
Taxon	NISP	(%)	MNI	NISP	(%)	MNI
Bos taurus	123		7	2494	55.16	22
OvisCapra	96		14	1031	22.80	48
[Ovis aries]	-	-	-	[101]	[2.23]	[8]
[Capra hircus]	-	-	-	[5]	[0.11]	[1]
Sus domesticus	71		8	780	17.25	
Canis familiaris	14		4	10	0.22	1
Equus sp.	6		2	12	0.27	2
[Equus caballus]	-	-	-	[1]	[0.02]	[1]
[Equus asinus]	[6]		[2]	[3]	[0.07]	[1]
Gallus sp.	-	-	-	161	3.56	15
Dama dama	-	-	-	-	-	-
Cervus elaphus	1		1	1	0.02	1
Capreolus capreolus	-	-	-	1	0.02	1
Lepus sp.	-	-	-	6	0.13	2
Testudo sp.	-	-	-	4	0.09	-
Total	317	-	-	4521	-	-

Table A.9: Taxonomic distributions of Locri Epiziphiri and Eraclea Lucana.

		Škrip		Grad	lina Rat I	LBA
Taxon	NISP	(%)	MNI	NISP	(%)	MNI
Bos taurus	17	12.14	-	9	2.64	1
OvisCapra	114	81.43	-	295	86.51	-
[Ovis aries]	[3]	[2.14]	-	[12]	[3.52]	-
[Capra hircus]	[3]	2.14]	-	[1]	[0.29]	[1]
Sus domesticus	3	2.14	-	6	1.75	
Canis familiaris	-	-	-	-	-	-
Equus sp.	-	-	-	-	-	-
[Equus caballus]	-	-	-	-	-	-
[Equus asinus]	-	-	-	-	-	-
Gallus sp.	-	-	-	-	-	-
Dama dama	-	-	-	-	-	-
Cervus elaphus	4	2.85	1	3	0.88	1
Capreolus capreolus	-	-	-	2	0.59	1
Lepus sp.	2	1.43	2	-	-	-
Testudo sp.	-	-	-	-	-	-
Total	140	-	-	341	-	-

Table A.10: Taxonomic distributions of Škrip and Late Bronze Age Gradina Rat.

	Gra	dina Rat	IA		Spila Nakovana			
Taxon	NISP	(%)	MNI		NISP	(%)	MNI	
Bos taurus	9	1.48	1		24	8.54	2	
OvisCapra	513	84.1			203	72.24	16	
[Ovis aries]	[29]	[4.75]			[16]	[5.69]	[1]	
[Capra hircus]	[22]	[3.61]			[2]	[0.71]	[1]	
Sus domesticus	12	1.97			5	1.78	2	
Canis familiaris	6	0.98			40	14.23	2	
Equus sp.	-	-	-		-	-	-	
[Equus caballus]	-	-	-		-	-	-	
[Equus asinus]	-	-	-		-	-	-	
Gallus sp.	-	-	-		-	-	-	
Dama dama	-	-	-		-	-	-	
Cervus elaphus	13	2.13	-		2	0.71	1	
Capreolus capreolus	9	1.48	-		7	2.49	1	
Lepus sp.	1	0.16	1		-	-	-	
Testudo sp.	-	-	-		-	-	-	
Total	610	-	-		281	-	-	

Table A.11: Taxonomic distributions of Iron Age Gradina Rat and Spila Nakovana.

		Pharos			Resnik			
Taxon	NISP	(%)	MNI	NISP	(%)	MNI		
Bos taurus	21	18.10	-	500	19.62	12		
OvisCapra	65	56.03	-	680	26.69	18		
[Ovis aries]	-	-	-	[81]	[3.18]	[10]		
[Capra hircus]	-	-	-	[37]	[1.45]	[4]		
Sus domesticus	10	8.62	-	224	8.79	9		
Canis familiaris	6	5.17	-	12	0.47	1		
Equus sp.	-	-	-	13	0.51	2		
[Equus caballus]	-	-	-	-	-	-		
[Equus asinus]	-	-	-	-	-	-		
Gallus sp.	5	4.31	-	2	0.07	1		
Dama dama	-	-	-	-	-	-		
Cervus elaphus	7	6.03	-	103	4.04	6		
Capreolus capreolus	-	-	-	8	0.31	1		
Lepus sp.	-	-	-	3	0.11	1		
Testudo sp.	-	-	-	8	0.31	1		
Total	116	-	-	2548	-	-		

Table A.12: Taxonomic distributions of Pharos and Resnik.



Figure A.1: Culling profiles (age-at-death) for Ovis aries of sites in Dalmatia. Age data here were calculated from post-cranial remains by fusion of epiphyses. While an apparent pattern might be considered between the Greek colonies of Pharos and Resnik and the indigenous sites of Spila Nakovana and Gradinga Rat, the increase in representation of remains of very young sheep at these sites is more likely related to the practice of fine sieving in their excavation. Faunal material from Pharos and Resnik being hand collected, such remains were likely not recovered and their potential presence cannot be quantified.

Comments					
C sineasure 5					
Measure 4					
Measure 3					
Measure 2	~				8.8 8.8
Measure 1	BT 25.2				L 18.:
Cutmarks	ı	•	•	•	ı
wand	1	ε	ı	ı	1
umg %	1	1	1	1	ı
Burning	ı	1	1	1	ı
Breakage	7	•	•	•	ı
oqvT gninodtsoW	ı	ı	ı	ı	ı
Weathering	ı	ı	ı	ı	ı
INW	ı	ı	ı	ı	ı
xəS	ı	•	•	•	1
Sex Criteria	ı	•	•	•	1
əgA	9	•	66	9	S
Age Criteria	1	66	6	-	36
Superior/Inferior	3	6	ε	4	4
Medial/Lateral	4	4	-	4	4
Anterior/Posterior	4	4	-	4	4
Complete	25	4	S	100	100
əbiZ	Г	100	Ж	Г	Г
Articulation	ı	ч	•	•	1
Weight(g)	7.6	ı	3.2	3.5	3.0
Length	45.5	4.5	25.0	23.3	18
Recent Break	1	26.0	1	1	1
Species	8	2	27	23	23
Portion	9		∞		
Element	38	80	77	111	240
Layer	-		3.1	3.3	4.1
Period	IA	IA	LBA	LBA	LBA

Table A.13: Example of coding technique used for sites of central Dalmatia analysed by self (Spila Nakovana, Gradina Rat, Pharos and Resnik).

Appendix B

Univariate Analyses

Teeth Measures



Figure B.1: Distribution of lengths of maxillary third molar (M^3) of *Bos taurus* across sites in the study. Bars are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.



Figure B.2: Distribution of lengths of maxillary third molar (M^3) of *Ovis aries* across sites in the study. Bars are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.



Figure B.3: Distribution of lengths of maxillary third molar (M^3) of *Sus domesticus* across sites in the study. Bars are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.

B.1 Univariate Analyses for *Bos taurus*



Figure B.4: Breadth comparisons of glenoid fossa of scapula (GLP) for *Bos taurus*. Markers colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.



Figure B.5: Breadth comparisons of humerus trochlea (BT) for *Bos taurus*. Markers colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.



Figure B.6: Breadth comparisons of proximal radius (Bp) for *Bos taurus*. Markers colour coded by site category. Measures given in mm.



Figure B.7: Breadth comparisons of distal radius (Bd) for *Bos taurus*. Markers colour coded by site category. Measures given in mm.



Figure B.8: Comparison of lengths (Gl) of metacarpal for *Bos taurus*. Markers colour coded by site category. Measures given in mm.



Figure B.9: Comparison of proximal breadths (Bp) of metacarpal for *Bos taurus*. Markers colour coded by site category. Measures given in mm.



Figure B.10: Comparison of proximal depths (Dp) of metacarpal for *Bos taurus*. Markers colour coded by site category. Measures given in mm.



Figure B.11: Comparison of lengths (Gl) of metatarsal for *Bos taurus*. Markers colour coded by site category. Measures given in mm.



Figure B.12: Comparison of proximal breadths (Bp) of metatarsal for *Bos taurus*. Markers colour coded by site category. Measures given in mm.



Figure B.13: Comparison of proximal depth (Dp) of metatarsal for *Bos taurus*. Markers colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.



Figure B.14: Comparison of lengths (GLl) of astragalus for *Bos taurus*. Markers colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm. Results of Mann-Whitney U tests are given in Table D.3.



Figure B.15: Comparison of breadths (Bd) of astragalus for *Bos taurus*. Markers colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm. Results of Mann-Whitney U tests are given in Table D.4.


Figure B.16: Comparison of depths (Dl) of astragalus for *Bos taurus*. Markers colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm. Results of Mann-Whitney U tests are given in Table D.5



Figure B.17: Comparison of distal breadths (Bd) of tibia for *Bos taurus*. Markers colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm. Results of Mann-Whitney U tests are given in Table D.1.



Figure B.18: Comparison of distal depths (Dd) of tibia for *Bos taurus*. Markers colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm. Results of Mann-Whitney U tests are given in Table D.2



Figure B.19: Comparison of lengths (Glpe) of first phalanx for *Bos taurus*. Markers colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm. Results of Mann-Whitney U tests are given in Table D.6



Figure B.20: Comparison of proximal breadths (Bp) of first phalanx for *Bos taurus*. Markers colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.

B.2 Univariate Analyses of Ovis aries



Figure B.21: Comparison of measures of breadth (BT) of humeral trochlea from *Ovis aries*. Size ranges are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measurements given in mm. Results of Mann-Whitney U tests are given in Table D.13.



Figure B.22: Breadth comparison of glenoid fossa of scapula (GLP) for *Ovis aries* of all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Length measures given in mm.



Figure B.23: Comparison of length (Gl) measures of the metacarpal for *Ovis aries* of all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.



Figure B.24: Comparison of measures of proximal breadth (Bp) of the metacarpal of *Ovis aries* for all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm. Results of Mann-Whitney U tests are given in Table D.14.



Figure B.25: Comparison of length (Gl) measures of the radius for *Ovis aries* of all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.



Figure B.26: Comparison of measures of proximal breadth (Bp) of the radius of *Ovis aries* for all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm. Results of Mann-Whitney U tests are given in Table D.15.



Figure B.27: Comparison of measures of proximal depth (Dp) of the radius of *Ovis aries* for all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.



Figure B.28: Comparison of measures of distal breadth (Bd) of the radius of *Ovis aries* for all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.



Figure B.29: Comparison of measures of distal depth (Dd) of the radius of *Ovis aries* for all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.



Figure B.30: Comparison of measures of distal breadth (Bd) of the tibia of *Ovis aries* for all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm. Results of Mann-Whitney U tests are given in Table D.16.



Figure B.31: Comparison of measures of distal depth (Dd) of the tibia of *Ovis aries* for all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm. Results of Mann-Whitney U tests are given in Table D.17.



Figure B.32: Comparison of length (Gl) measures of the metatarsal for *Ovis aries* of all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.



Figure B.33: Comparison of measures of proximal breadth (Bp) of the metatarsal of *Ovis aries* for all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm. Results of Mann-Whitney U tests are given in Table D.18.



Figure B.34: Comparison of measures of proximal depth (Dp) of the metatarsal of *Ovis aries* for all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.



Figure B.35: Comparison of length (Gl) measures of the calcaneus for *Ovis aries* of all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.



Figure B.36: Comparison of length (GLl) measures of the astragalus for *Ovis aries* of all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm. Results of Mann-Whitney U tests are given in Table D.19.



Figure B.37: Comparison of breadth (Bd) measures of the astragalus for *Ovis aries* of all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm. Results of Mann-Whitney U tests are given in Table D.20.



Figure B.38: Comparison of depth (Dl) measures of the astragalus for *Ovis aries* of all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm. Results of Mann-Whitney U tests are given in Table D.21.



Figure B.39: Comparison of length (Glpe) measures of the first phalanx for *Ovis aries* of all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm. Results of Mann-Whitney U tests are given in Table D.22.



Figure B.40: Comparison of proximal breadth (Bp) measures of the first phalanx for *Ovis aries* of all sites in the study. Results are colour coded by site category, with green for Greek sites, red for indigenous southern Italian sites, blue for Italian colonies, purple for Dalmatian indigenous sites, and light blue for Dalmatian colonies. Measures given in mm.

B.3 Univariate Analyses for *Capra hircus*



Figure B.41: Comparison of measures of breadth of glenoid fossa (GLP) of scapula of *Capra hircus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.42: Comparison of measures of breadth of distal humerus trochlea (BT) of *Capra hircus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.43: Comparison of measures of breadth proximal radius (Bp) of *Capra hircus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.44: Comparison of measures of breadth of distal radius (Bd) of *Capra hircus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.45: Comparison of measures of proximal breadth of metacarpal (Bp) of *Capra hircus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.46: Comparison of measures of proximal depth of metacarpal (Dp) of *Capra hircus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.47: Comparison of measures of distal breadth of metatarsal (Bd) of *Capra hircus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.48: Comparison of measures of distal breadth of tibia (Bd) of *Capra hircus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.49: Comparison of measures of length of astragalus (GLl) of *Capra hircus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.50: Comparison of measures of breadth of astragalus (Bd) of *Capra hircus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.51: Comparison of measures of length of first phalanx (Glpe) of *Capra hircus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.52: Comparison of measures of proximal breadth of first phalanx (Bp) of *Capra hircus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.

B.4 Univariate Analyses for Sus domesticus



Figure B.53: Comparison of measures of breadth of glenoid fossa (GLP) of scapula of *Sus domesticus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.54: Comparison of measures of breadth of trochlea of distal humerus (BT) of *Sus domesticus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.55: Comparison of measures of proximal breadth of radius (Bp) of *Sus domesticus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.56: Comparison of measures of proximal breadth of metacarpal (Bp) of *Sus domesticus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.57: Comparison of measures of distal breadth of tibia (Bd) of *Sus domesticus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.58: Comparison of measures of distal depth of tibia (Dd) of *Sus domesticus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.59: Comparison of measures of length of third metatarsal (Gl) of *Sus domesticus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.60: Comparison of measures of proximal breadth of third metatarsal (Bp) of *Sus domesticus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.61: Comparison of measures of proximal breadth of fourth metatarsal (Bp) of *Sus domesticus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.62: Comparison of measures of length of astragalus (GLl) of *Sus domesticus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.63: Comparison of measures of breadth of astragalus (Bd) of *Sus domesticus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.64: Comparison of measures of depth of astragalus (Dl) of *Sus domesticus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.65: Comparison of measures of length of calcaneus (Gl) of *Sus domesticus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.66: Comparison of measures of length of first phalanx (Glpe) of *Sus domesticus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.



Figure B.67: Comparison of measures of proximal breadth of first phalanx (Bp) of *Sus domesticus* from all sites in the study. Markers are colour coded by site category. Measures are given in mm.

Appendix C

Bivariate Analyses

C.1 Bivariate Graphs of Bos taurus

Measure	mm	Measure	mm	Measure	mm				
Scapula									
GL	479.5	DHA	481.5	SLC	85.0				
GLP	99.8	BG	78.7	LG	79.5				
Humerus									
GL	413.0	GLC	349.2	Bp	150.5				
Dp	141.0	SD	60.5	BT	107.0				
Bd	119.0	Dd	108.5						
Radius									
GL	363.8	Bp	115.2	BFp	104.0				
Dp	60.5	SD	67.0	Bd	109.5				
Dd	62.0	BFd	107.5						
Ulna									
GL	468.5	LO	152.0	DPA	120.5				
Metacarpal									
GL	238.3	Bp	83.2	Dp	51.2				
SD	51.2	Bd	83.5	Dd	42.0				
Os Coxa									
LA	75.5	LAR	93.0						
		Fem	ur						
GL	499.8	GLC	447.2	DC	64.0				
Вр	166.2	SD	55.2	Bd	130.0				
Dd	174.0								
Tibia									
GL	459.1	Bp	139.5	Dp	112.5				
SD	57.6	Bd	87.5	Dd	69				
		Astrag	alus						
GLI	89.0	GLm	80.5	Bd	60.5				
Dl	54.5	Dm	51.0						
		Calcan	ieus						
GL	181.5	GB	77.5						
		Metata	rsal						
GL	291.0	Bp	69.5	Dp	69.5				
SD	41.0	Bd	78.0	Dd	41.5				
Phalanx 1									
GLpe	80.5	Bp	41.5						
SD	34.5	Bd	41.5						
Phalanx 2									
GL	56.5	Bp	43.5						
SD	32.3	Bd	38.0						
Phalanx 3									
DLS	90.5	Ld	69.0	MBS	33.0				

Table C.1: Standard measures used to calculate LSI for *Bos taurus* measurements from sites in the Study. These measures of a single complete skeleton of aurochs (*Bos primigenius*) were recorded from specimen H.29.021 from the University Museum of Zoology, Cambridge. This specimen dates to *c*.4000BP and was excavated from Burwell Fen, Cambridgeshire. Measures given here come from left elements. All measures given in mm.



Figure C.1: Graphical comparison of measures of breadth (GLP) and depth (BG) of glenoid fossa of scapula for *Bos taurus* from all sites. Site markers are colour coded by site category. Measures are given in mm.



Figure C.2: Graphical comparison of measures of breadth (Bp) and depth (Dp) of proximal radius for *Bos taurus* from all sites. Site markers are colour coded by site category. Measures are given in mm.



Figure C.3: Graphical comparison of measures of length (Gl) and proximal breadth (Bp) of metacarpal for *Bos taurus* from all sites. Site markers are colour coded by site category. Measures are given in mm.



Figure C.4: Graphical comparison of measures of proximal breadth (Bp) and depth (Dp) of metacarpal for *Bos taurus* from all sites. Site markers are colour coded by site category. Measures are given in mm.



Figure C.5: Graphical comparison of measures of distal breadth (Bd) and depth (Dd) of metacarpal for *Bos taurus* from all sites. Site markers are colour coded by site category. Measures are given in mm.



Figure C.6: Graphical comparison of measures of distal breadth (Bd) and depth (Dd) of tibia for *Bos taurus* from all sites. Site markers are colour coded by site category. Measures are given in mm.



Figure C.7: Graphical comparison of measures of length (Gl) and proximal breadth (Bp) of metatarsal for *Bos taurus* from all sites. Site markers are colour coded by site category. Measures are given in mm.



Figure C.8: Graphical comparison of measures of proximal breadth (Bp) and depth (Dp) of metatarsal for *Bos taurus* from all sites. Site markers are colour coded by site category. Measures are given in mm.



Figure C.9: Graphical comparison of measures of distal breadth (Bd) and depth (Dd) of metatarsal for *Bos taurus* from all sites. Site markers are colour coded by site category. Measures are given in mm.



Figure C.10: Graphical comparison of measures of length (Glpe) and proximal breadth (Bp) of first phalanx for *Bos taurus* from all sites. Site markers are colour coded by site category. Measures are given in mm.

C.2 Bivariate Graphs of Ovis aries

Measure	mm	Measure	mm	Measure	mm				
Scapula									
GL		DHA	179.5	SLC	22.3				
GLP	35.0	BG	23.7	LG	27.3				
Humerus									
GL	160.5	GLC	148.0	Bp	42.5				
Dp		SD	18.4	BT	29.6				
Bd	32.2	Dd							
Radius									
GL	172.0	Bp	32.5	BFp	29.2				
Dp	16.3	SD	19.7	Bd	31.7				
Dd	22.0	BFd	24.7						
Ulna									
GL	133.5	LO	49.0	DPA	28.9				
SDO	24.2	BPC	18.1						
Metacarpal									
GL	138.1	Bp	24.3	Dp	17.5				
SD	15.8	Bd	26.9	Dd	12.5				
Femur									
GL	199.5	GLC	193.5	DC	21.9				
Вр	49.4	SD	19.3	Bd	41.6				
		Dd	49.0						
Tibia									
GL	237.5	Bp	47.0	Dp	45.0				
SD	17.9	Bd	28.6	Dd	22.2				
		Astraga	lus						
GLl	31.3	GLm	29.1	Bd	20.0				
Dl	17.2	Dm	18.4						
Calcaneus									
GL	60.7	GB	19.3						
Metatarsal									
GL	150.6	Bp	22.4	Dp	21.1				
SD	13.6	Bd	25.6	Dd	17.4				
Phalanx 1									
GLpe	40.9	Bp	12.0						
SD	9.9	Bd	11.8						
Phalanx 2									
GL	25.8	Bp	13.9						
SD	9.9	Bd	11.0						
Phalanx 3									
DLS	29.4	Ld	24.5	MBS	6.5				

Table C.2: Standard measures used for the calculation of LSI values for measurements of *Ovis aries*. Measures here come from a complete sub-cranial specimen of a modern wild mouflon (*Ovis orientalis*) collected by Prof. A. Legge in Croatia. Adult male. Measures of left elements are given here. All measures given in mm.



Figure C.11: Graphical comparison of proximal breadth (Bp) and depth (Dp) of radius of *Ovis aries* from all sites in the study. Site markers are colour coded by site category. Measures are given in mm.



Figure C.12: Graphical comparison of distal breadth (Bd) and depth (Dd) of radius of *Ovis aries* from all sites in the study. Site markers are colour coded by site category. Measures are given in mm.


Figure C.13: Graphical comparison of measures of length (Gl) and proximal breadth (Bp) of metacarpal of *Ovis aries* from all sites in the study. Site markers are colour coded by site category. Measures are given in mm.



Figure C.14: Graphical comparison of measures of proximal breadth (Bp) and depth (Dp) of metacarpal of *Ovis aries* from all sites in the study. Site markers are colour coded by site category. Measures are given in mm.



Figure C.15: Graphical comparison of measures distal breadth (Bd) and depth (Dd) of tibia of *Ovis aries* from all sites in the study. Site markers are colour coded by site category. Measures are given in mm.



Figure C.16: Graphical comparison of measures of length (Gl) and proximal breadth (Bp) of metatarsal of *Ovis aries* from all sites in the study. Site markers are colour coded by site category. Measures are given in mm.



Figure C.17: Graphical comparison of measures proximal breadth (Bp) and depth (Dp) of metatarsal of *Ovis aries* from all sites in the study. Site markers are colour coded by site category. Measures are given in mm.



Figure C.18: Graphical comparison of measures of length (GLl) and proximal breadth (Bd) of astragalus of *Ovis aries* from all sites in the study. Site markers are colour coded by site category. Measures are given in mm.



and southern Italian indigenous (red) sites. Mean values for each site are shown through the markers with crosshairs. The crosshairs Figure C.19: Log size index (LSI) comparison of proximal breadth (Bp) and depth (Dp) of all elements for Ovis aries from Greek (green) illustrate one standard deviation. LSI values have been multiplied by 100 for ease of display.



southern Italian indigenous and colony sites. Mean values for each site are shown through the markers with crosshairs. The crosshairs Figure C.20: Log size index (LSI) comparison of proximal breadth (Bp) and depth (Dp) of all elements for Ovis aries from Greek and illustrate one standard deviation. LSI values have been multiplied by 100 for ease of display.

Dalmatian Sites



Figure C.21: Comparison of measures of length (GLl) and depth (Dl) of astragalus of *Ovis aries* from sites of Greece and Dalmatia. Markers colour coded by site category. Measures given in mm.



Figure C.22: Comparison of measures of length (Glpe) and proximal breadth (Bp) of first phalanx of *Ovis aries* from sites of Greece and Dalmatia. Markers colour coded by site category. Measures given in mm.



Figure C.23: Comparison of LSI values of length (Gl) and proximal breadth (Bp) of *Ovis aries* from sites of Greece and Dalmatia. Markers colour coded by site category. Measures given in mm.

C.3 Bivariate Graphs for Capra hircus



Figure C.24: Comparison of LSI values of proximal breadth (Bp) and depth (Dp) of *Ovis aries* from sites of Greece and Dalmatia. Markers colour coded by site category. Measures given in mm.



Figure C.25: Graph of bivariate ditribution of measures of breadth (GLP) and depth (BG) of scapula from *Capra hircus* for all sites. Markers are colour coded by site category. Measures given in mm.



Figure C.26: Graph of bivariate ditribution of measures of proximal breadth (Bp) and depth (Dp) of radius of *Capra hircus* for all sites. Markers are colour coded by site category. Measures given in mm.



Figure C.27: Graph of bivariate ditribution of measures of proximal breadth (Bp) and depth (Dp) of proximal metacarpal of *Capra hircus* for all sites. Markers are colour coded by site category. Measures given in mm.



Figure C.28: Graph of bivariate ditribution of measures of distal breadth (Bd) and depth (Dd) of metacarpal of *Capra hircus* for all sites. Markers are colour coded by site category. Measures given in mm.



Figure C.29: Graph of bivariate ditribution of measures of distal breadth (Bd) and depth (Dd) of tibia of *Capra hircus* for all sites. Markers are colour coded by site category. Measures given in mm.



Figure C.30: Graph of bivariate ditribution of measures of distal breadth (Bd) and depth (Dd) of metatarsal of *Capra hircus* for all sites. Markers are colour coded by site category. Measures given in mm.



Figure C.31: Graph of bivariate ditribution of measures of length (Gl) and breadth (Bd) of astragalus of *Capra hircus* for all sites. Markers are colour coded by site category. Measures given in mm.



Figure C.32: Graph of bivariate ditribution of measures of length (GLpe) and proximal breadth (Bp) of first phalanx of *Capra hircus* for all sites. Markers are colour coded by site category. Measures given in mm.

C.4 Bivariate Graphs for Sus domesticus

			Scap	ula			
DHA	210.5		BG	29.0		GLP	37.0
SLC	25.0		LG	29.5			
			Hume	erus			
GL	218.5		GLC	190.0		SD	18.5
Bp	53.0		Bd	45.0			1010
DP	00.0		Radi	ius			
GL	159 5		Bn	29.5		Dn	23.0
SD SD	19.0			19.0		DP	23.0
Bd	36.5		Dd	27.0			
Du	50.5		Ulr	27.0			
GI	222.0			66.0		DPA	41.0
SDO	33.0		BPC	23.5		DIM	41.0
M	etacarnal	2	DIC	25.5	M	tacarna	15
GI		- <i>2</i>			IVI	GI	58.0
UL	57.5		Metaca	rnal 3		OL	50.0
GI	77.0		IeP	76.0			
Bn	24.0		Rd	19.0		B	16.0
Бр	24.0		Metaca	rnal 4		D	10.0
GI	78.0		I oP	74.0			
Bn	17.0		Rd	18.0		B	13.0
вр	17.0			10.0		D	15.0
	ΙΛ	34.0		Uxa	ΙΛΡ	38.0	
		34.0 27.0			CD LAK	30.0	
	ы	27.0	 Eam		30	12	
CI	207.5		Pen Pe			Da	56.0
	207.5		вр	34.5		Dp	30.0
3D	21.3 Eib	1-	Би	52.0	Matat	Du	29.3
		ula			CI	$\frac{65.0}{1}$	
	GL	200.5	Matata	maal 2	GL	05.0	
CI	075			rsar 3			1
UL Da	07.3		D	83.3 17.0		D	12.5
вр	18.0		Bu	17.0		В	13.5
CI	02.5		Metata	rsal 4			
GL	92.5		LeP	91.0		D	14.0
Вр	17.0		Bd	18.0		В	14.0
	(0.0		Metaca	rpal 5			
GL	68.0			1			
	12.0	[Astrag	galus			
GLI	42.0		GLm	39.0		D 1	22.0
DI	21.5		Dm	26.0		Bd	23.0
	07.0		Calcar	neus			
GL	87.0		GB	25.0			
	26.0		Phala	nx I			
GLpe	36.0		SD D	14.0			
Вр	19.0		Bd	17.5			
	2=		Phala	nx 2			1
GL	27		SD	14.0			
Вр	17.5		Bd	14.0			
			Phala	nx 3			
Ld	33.0		DLS	36.0		MBS	14.0

Table C.3: Standard measures used in the calculation of LSI for Sus domesticus. Measures takenfrom Specimen number 316 of female adult wild boar, Cambridge University Grahame Clark Lab-oratory for Zooarchaeology. All measures given here come from left elements. Measures given inmm.285



Figure C.33: Graph of bivariate distribution of measures of breadth (GLP) and depth (BG) of glenoid fossa of scapula from *Sus domesticus* for all sites. Markers are colour coded by site category. Measures given in mm.



Figure C.34: Graph of bivariate distribution of measures of proximal breadth (Bp) and depth (Dp) of radius from *Sus domesticus* for all sites. Markers are colour coded by site category. Measures given in mm.



Figure C.35: Graph of bivariate distribution of measures of length (Gl) and breadth (Bp) of third metacarpal from *Sus domesticus* for all sites. Markers are colour coded by site category. Measures given in mm.



Figure C.36: Graph of bivariate distribution of measures of length (Gl) and breadth (Bp) of fourth metacarpal from *Sus domesticus* for all sites. Markers are colour coded by site category. Measures given in mm.



Figure C.37: Graph of bivariate distribution of measures of distal breadth (Bd) and depth (Dd) of tibia from *Sus domesticus* for all sites. Markers are colour coded by site category. Measures given in mm.



Figure C.38: Graph of bivariate distribution of measures of length (Gl) and breadth (Bp) of fourth metatarsal from *Sus domesticus* for all sites. Markers are colour coded by site category. Measures given in mm.



Figure C.39: Graph of bivariate distribution of measures of length (GLl) and depth (Dl) of astragalus from *Sus domesticus* for all sites. Markers are colour coded by site category. Measures given in mm.



Figure C.40: Graph of bivariate distribution of measures of length (GLl) and breadth (Bd) of astragalus from *Sus domesticus* for all sites. Markers are colour coded by site category. Measures given in mm.



Figure C.41: Graph of bivariate distribution of measures of length (Glpe) and breadth (GLP) of first phalanx from *Sus domesticus* for all sites. Markers are colour coded by site category. Measures given in mm.

Appendix D

Statistical Assessments

D.1 Statistical Test Results for *Bos taurus*

Pharos (2)														ı
Gradina Rat LBA (1)													I	
Pantanello Sanctuary (13)	0.000		0.627	0.000			0.001			0.079		I		
(1) initnaJ											I			
Roccagloriosa (4)	0.026		0.142	0.006			0.038			I		0.079		
Pomarico Vecchio (1)									I					
Incoronata (2)								I						
(6) OllibroM Strot	0.733		0.000	0.138			ı			0.038		0.001		
Termitito (1)						I								
Monte Irsi (1)					ı									
(7) atagivə ^N aqqoD	0.126		0.000	I			0.138			0.006		0.000		
Kassope (25)	0.000			0.000			0.000			0.142		0.627		
Poseidon a Tenos (2)		ı												
Kastanas (11)	ı		0.000	0.126			0.733			0.026		0.000		
	Kastanas	Poseidon a Tenos	Kassope	Coppa Nevigata	Monte Irsi	Termitito	Torre Mordillo	Incoronata	Pomarico Vecchio	Roccagloriosa	Lentini	Pantanello Sanctuary	Gradina Rat LBA	Pharos

Gradina Rat LBA (1)										I
Pantanello Sanctuary (13)	0.000	0.000			0.000		0.163		ı	
(1) initnaJ								ı		
Roccagloriosa (4)	0.056	0.012			0.019		I		0.163	
Incoronata (2)						ı				
(6) ollibroM srroT	0.808	0.836			I		0.019		0.000	
Termitito (1)				ı						
Monte Irsi (1)			ı							
Coppa Nevigata (7)	0.596				0.836		0.012		0.000	
Kastanas (11)	1	0.596			0.808		0.056		0.000	
	Kastanas	Coppa Nevigata	Monte Irsi	Termitito	Torre Mordillo	Incoronata	Roccagloriosa	Lentini	Pantanello Sanctuary	Gradina Rat LBA

Table D.2: Results of Mann-Whitney U tests performed on depths of distal tibia (Dd) of Bos taurus. The number of bones measured for test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Mann-Whitney U distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted.

Resnik (1)																	I
Pharos (1)																ı	
Gradina Rat IA (1)															I		
Eraclea Lucana (1)														ı			
Pantanello Sanctuary (15)	0.000	0.036	0.154	0.270	0.000			0.000	0.001	0.000			I				
(1) ainoluaX												ı					
(1) initnaJ											I						
Roccagloriosa (12)	0.004	0.083	0.067	0.000	0.000			0.001	0.170	I			0.000				
Incoronata (4)	0.317	0.019	0.019	0.000	0.032			0.029	I	0.170			0.001				
(4) Torre Mordillo (4)	0.031	0.010	0.010	0.000	0.413			ı	0.029	0.001			0.000				
Termitito (1)							ı										
(1) izrl ətnoM						ı											
Coppa Nevigata (5)	0.085	0.004	0.004	0.000	I			0.413	0.032	0.000			0.000				
Kassope (39)	0.000	0.140	0.317	ı	0.000			0.000	0.000	0.000			0.270				
(d) sonsT & nobissoq	0.001	0.589	I	0.317	0.004			0.010	0.019	0.067			0.154				
Kabiren bei Theben (6)	0.001	I	0.589	0.140	0.004			0.010	0.019	0.083			0.036				
(71) sanaseX	ı	0.001	0.001	0.000	0.085			0.031	0.317	0.004			0.000				
	Kastanas	Kabiren bei Theben	Poseidon a Tenos	Kassope	Coppa Nevigata	Monte Irsi	Termitito	Torre Mordillo	Incoronata	Roccagloriosa	Lentini	Kaulonia	Pantanello Sanctuary	Eraclea Lucana	Gradina Rat IA	Pharos	Resnik

Table D.3: Results of Mann-Whitney U tests performed on astragalus lengths (GI) of Bos taurus. The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted.

	,														
Resnik (1)															I
Pharos (1)														ı	
Gradina Rat IA (1)													I		
Eraclea Lucana (2)												ı			
Pantanello Sanctuary (15)	0.000	0.001	0.002	0.001	0.000		0.001	0.001			1				
(1) sinolusX										ı					
Lentini (2)									ı						
Incoronata (4)	0.099	0.352	0.286	0.003	0.016		0.029	1			0.001				
Torre Mordillo (4)	0.031	0.010	0.016	0.000	0.001		1	0.029			0.001				
Termitito (1)						ı									
Coppa Nevigata (5)	0.085	0.004	0.008	0.000	ı		0.001	0.016			0.000				
Kassope (37)	0.000	0.031	0.050	ı	0.000		0.000	0.003			0.001				
(S) sonsT & nobissoA	0.009	0.931	,	0.050	0.008		0.016	0.286			0.002				
Kabiren bei Theben (6)	0.004	ı	0.931	0.031	0.004		0.010	0.352			0.001				
Kastanas (17)	1	0.004	0.009	0.000	0.085		0.031	0.099			0.000				
	Kastanas	Kabiren bei Theben	Poseidon a Tenos	Kassope	Coppa Nevigata	Termitito	Torre Mordillo	Incoronata	Lentini	Kaulonia	Pantanello Sanctuary	Eraclea Lucana	Gradina Rat IA	Pharos	Resnik

Table D.4: Results of Mann-Whitney U tests performed on astragalus breadths (Bd) of Bos taurus. The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted.

Resnik (1)													I
Pharos (1)												ı	
Gradina Rat IA (1)											1		
Eraclea Lucana (1)										ı			
Lentini (1)									1				
Roccagloriosa (12)	0.000	0.001	0.000	0.000	0.000		0.001	ı					
(4) ollibroM stroT	0.052	0.029	0.010	0.000	0.286		ı	0.001					
(1) isrl strom						1							
Coppa Nevigata (5)	0.319	0.016	0.009	0.000	I		0.286	0.000					
Kassope (36)	0.000	0.003	0.000	ı	0.000		0.000	0.000					
(d) sonoT a Tenos (d)	0.016	0.610		0.000	0.009		0.010	0.000					
Kabiren bei Theben (4)	0.040		0.610	0.003	0.016		0.029	0.001					
(71) senetseX	1	0.040	0.016	0.000	0.319		0.052	0.000					
	Kastanas	Kabiren bei Theben	Poseidon a Tenos	Kassope	Coppa Nevigata	Monte Irsi	Torre Mordillo	Roccagloriosa	Lentini	Eraclea Lucana	Gradina Rat IA	Pharos	Resnik

Table D.5: Results of Mann-Whitney U tests performed on astragalus depths (DI) of Bos taurus. The number of bones measured for test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Mann-Whitney U distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted.

Resnik (4)	0.000	0.018		*		0.009				I
(1) anavodana (1)									ı	
Gradina Rat LBA (2)								ı		
(1) sinolusX							ı			
Eraclea Lucana (21)	0.000	0.462	0.252	0.000		ı				0.009
Lentini (2)					ı					
Torre Mordillo (10)	0.116	0.000	0.001	ı		0.000				*
Poseidon a Tenos (3)	0.000	0.753	1	0.001		0.252				
Kabiren bei Theben (7)	0.000		0.753	0.000		0.462				0.018
(de) seneres (de)	ı	0.000	0.000	0.116		0.000				0.000
	Kastanas	Kabiren bei Theben	Poseidon a Tenos	Torre Mordillo	Lentini	Eraclea Lucana	Kaulonia	Gradina Rat LBA	Spila Nakovana	Resnik

Table D.6: Results of Mann-Whitney U tests performed on lengths of first phalanx (GLpe) of Bos taurus. The number of bones measured or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the for each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, Those sites for which no test was run (as between a southern Italian Greek colony and a Dalmatian indigenous site) are marked with an distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. asterisk (*)

Spila Nakovana (2)																					ī
Gradina Rat IA (2)																				ı	
Gradina Rat LBA (1)																			ı		
Resnik (12)	0.000	0.817	0.032	0.379	*		*	*	*		*	0.820	0.219	0.252		0.005	0.088	ı			
Pharos (2)	0.352	0.007	0.001	0.026	*		*	*	*		*	Pharos	0.327	0.026		0.005	,	0.088			
Pantanello Sanctuary (28)	0.000	0.000	0.174	0.009	0.000		0.000	0.000	0.000		0.000	0.057	0.000	0.000		,	0.005	0.005			
(0) iningephiri (0)															ı						
Eraclea Lucana	0.000	0.009	0.000	0.005	0.000		0.000	0.913	0.000		0.926	0.677	0.208	ı		0.000		0.252			
(9) Lentini (9)	0.188	0.037	0.001	0.038	0.024		0.004	0.340	0.003		0.277	0.272	-	0.208		0.000	0.327	0.219			
(d) sinolus X	0.012	0.530	0.146	0.350	0.000		0.000	0.776	0.010		0.750	ı	0.272	0.677		0.057	Kaul	0.820			
Roccagloriosa	0.000	0.044	0.000	0.007	0.000		0.000	0.917	0.001		ı	0.750	0.277	0.926		0.000	*	*			
Pomarico Vecchio (0)										ı							*				
Monte Irsi (4)	0.000	0.000	0.000	0.001	0.002		0.003	0.003	ı		0.001	0.010	0.003	0.000		0.000	*	*			
(9) Incoronata	0.003	0.057	0.000	0.038	0.000		0.000		0.003		0.917	0.776	0.340	0.913		0.000	*	*			
Coppa Nevigata	0.005	0.000	0.000	0.000	0.353		ı	0.000	0.003		0.000	0.000	0.004	0.000		0.000	*	*			
(1) Termitito (1)							0.167							0.327							
(20) Torre Mordillo (29)	0.016	0.000	0.000	0.000	1		0.353	0.000	0.002		0.000	0.000	0.024	0.000		0.000	*	*			
(11) sonsT s nobissoA	0.000	0.396	0.071	ı	0.000		0.000	0.038	0.001		0.007	0.350	0.038	0.005		0.009	0.026	0.379			
Kassope (55)	0.000	0.001	ı	0.071	0.000		0.000	0.000	0.000		0.000	0.146	0.001	0.000		0.174	0.001	0.032			
Kabiren bei Theben (22)	0.000	ı	0.001	0.396	0.000		0.000	0.057	0.000		0.044	0.530	0.037	0.009		0.000	0.007	0.817			
(17) sanaseM		0.000	0.000	0.000	0.016		0.005	0.003	0.000		0.000	0.012	0.188	0.000		0.000	0.352	0.000			
	Kastanas	Kabiren bei Theben	Kassope	Poseidon a Tenos	Torre Mordillo	Termitito	Coppa Nevigata	Incoronata	Monte Irsi	Pomarico Vecchio	Roccagloriosa	Kaulonia	Lentini	Eraclea Lucana	Locri Epizephiri	Pantanello Sanctuary	Pharos	Resnik	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana

The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. Those sites for which no test was run (as between a southern Italian Greek colony and a Table D.7: Results of Mann-Whitney U tests conducted on LSI values of greatest length (GL) of Bos taurus elements from all sites. were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Dalmatian indigenous site) are marked with an asterisk (*).

Spila Nakovana (2)																					•
Gradina Rat IA (1)																				•	
Gradina Rat LBA (2)																					
Resnik (13)	0.006	0.218	0.338	0.650	*	*	*	*		*	*	0.579	0.331	0.862		0.027	0.305	-			
Pharos (2)	0.650	0.008	0.052	0.026	*	*	*	*		*	*	Pharos	0.308	0.113		0.021	ı	0.305			
Pantanello Sanctuary (41)	0.000	0.265	0.026	0.054	0.000	PanSan	0.000	0.000		0.094	0.123	0.039	0.002	0.000			0.021	0.027			
(1) iningeprint (1)																					
Eraclea Lucana	0.000	0.018	0.092	0.278	0.001	0.134	0.000	0.023		0.770	0.000	0.706	0.108	ı		0.000	0.113	0.862			
(11) iniinsL	0.057	0.002	0.024	0.018	0.308	0.659	0.000	0.955		0.510	0.001	0.180	0.057	0.108		0.002	0.308	0.331			
(d) sinolusX	0.029	0.125	0.218	0.207	0.283	0.167	0.000	0.416		1.000	0.051	ı	0.180	0.706		0.039	Kaul	0.579			
(14) ธรอาการรูโอการรูโอการรูโอการรูโอการรูโอการรูโอการรูโอการรูโอการรูโอการรูโอการรูโอการรูโอการรูโอการรูโอการ	0.000	0.034	0.007	0.004	0.000	0.012	0.000	0.000		0.056	•	0.051	0.001	0.000		0.123	*	*			
Ροπατίεο Vecchio (5)	0.078	0.250	0.397	0.444	0.262	0.786	0.003	0.289		1	0.056	1.000	0.510	0.770		0.094	*	*			
Monte Irsi (1)									1												
Incoronata (10)	0.151	0.000	0.001	0.002	0.748	0.439	0.000	ı		0.289	0.000	0.416	0.955	0.023		0.000	*	*			
sısışıvəN sqqoD	0.000	0.000	0.000	0.000	0.019	0.014	ı	0.000		0.003	0.000	0.000	0.000	0.000		0.000	*	*			
Termitito (3)	0.495	0.001	0.056	0.032	0.819	•	0.014	0.439		0.786	0.012	0.167	0.659	0.134		0.011	*	*			
Torre Mordillo (32)	0.530	0.000	0.000	0.001		0.819	0.019	0.748		0.262	0.000	0.283	0.308	0.001		0.000	*	*			
Poseidon a Tenos (14)	0.000	0.342	0.745	·	0.001	0.032	0.000	0.002		0.444	0.004	0.207	0.018	0.278		0.054	0.026	0.650			
Kassope (64)	0.000	0.488	•	0.745	0.000	0.056	0.000	0.001		0.397	0.007	0.218	0.024	0.092		0.026	0.052	0.338			
Kabiren bei Theben (21)	0.000		0.488	0.342	0.000	0.001	0.000	0.000		0.250	0.034	0.125	0.002	0.018		0.264	0.008	0.218			
(98) senstends (89)	1	0.000	0.000	0.000	0.530	0.495	0.000	0.151		0.078	0.000	0.029	Kastanas	0.000		0.000	0.650	0.006			
	Kastanas	Kabiren bei Theben	Kassope	Poseidon a Tenos	Torre Mordillo	Termitito	Coppa Nevigata	Incoronata	Monte Irsi	Pomarico Vecchio	Roccagloriosa	Kaulonia	Lentini	Eraclea Lucana	Locri Epizephiri	Pantanello Sanctuary	Pharos	Resnik	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana

Table D.8: Results of Mann-Whitney U tests conducted on LSI values of proximal breadth (Bp) of *Bos taurus* elements from all sites. The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. Those sites for which no test was run (as between a southern Italian Greek colony and a Dalmatian indigenous site) are marked with an asterisk (*).

(1) ansvorana (1)																					•
Gradina Rat IA (1)																				•	
Gradina Rat LBA (0)																					
Resnik (3)	0.091	0.548	0.326	0.548	*	*	*	*						0.667		0.059		ı	ı		
Pharos (2)	0.940	0.857	0.126	0.857	*	*	*	*						0.333		0.041	ı	0.400			
Pantanello Sanctuary (38)	0.000	0.000	0.000	0.000	0.000		0.000	0.000						0.042		ı		0.059			
Locri Epizephiri (0)																					
Eraclea Lucana	0.000	0.234	0.647	0.073	0.006		0.000	0.005						ı		0.042		0.667			
(1) International (1)	0.082	0.286	0.914	0.286	0.400		0.143	0.154					ı	1.000		0.513		1.000			
(0) sinolusX												ı									
Roccagloriosa (0)											•										
Pomarico Vecchio (2)																					
Monte Irsi (2)	0.620	0.071	0.013	0.071	0.533		0.800	0.088	1					0.056		0.003					
Incoronata (12)	0.001	0.083	0.000	0.151	0.002		0.000	ı						0.005		0.000	*	*			
Coppa Nevigata	0.025	0.000	0.000	0.000	0.549			0.000						0.000		0.000	*	*			
Termitito (2)	0.558	0.071	0.010	0.071	1.000	ı	0.933	0.044						0.056		0.003	*	*			
(4) ollibroM strof	0.083	0.010	0.000	0.010			0.549	0.002						0.006		0.000	*	*			
(d) sonsT s nobiseoP	0.000	0.589	0.028	ı	0.010		0.000	0.151						0.073		0.000		0.548			
(69) əqossaX	0.000	0.034	,	0.028	0.000		0.000	0.000						0.647		0.000		0.326			
(6) Kabiren bei Theben (6)	0.000		0.034	0.589	0.010		0.000	0.083						0.234		0.000		0.548			
(48) kastanas (48)		0.000	0.000	0.000	0.083		0.025	0.001						0.000		0.000		0.091			
	Kastanas	Kabiren bei Theben	Kassope	Poseidon a Tenos	Torre Mordillo	Termitito	Coppa Nevigata	Incoronata	Monte Irsi	Pomarico Vecchio	Roccagloriosa	Kaulonia	Lentini	Eraclea Lucana	Locri Epizephiri	Pantanello Sanctuary	Pharos	Resnik	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana

The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. Those sites for which no test was run (as between a southern Italian Greek colony and a Table D.9: Results of Mann-Whitney U tests conducted on LSI values of proximal depth (Dp) of Bos taurus elements from all sites. were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Dalmatian indigenous site) are marked with an asterisk (*).

(1) anavoda sliq2																					•
(1) AI at IA (1)																				•	
Gradina Rat LBA (2)																					
Resnik (12)	0.028	0.058	0.018	0.164	*	*	*	*		*	*	0.702	0.887	0.605		0.002	0.521	ı	I		
Pharos (4)	0.346	0.081	0.045	0.116	*	*	*	*		*	*	Pharos	0.103	0.146		0.027	1	0.521			
Pantanello Sanctuary (35)	0.000	0.045	0.036	0.028	0.000	0.000	0.000	0.000		0.002	0.976	0.003	0.007	0.000		ı	0.027	0.002			
(0) iningeria (0)															ı						
Eraclea Lucana	0.000	0.000	0.000	0.004	0.001	0.074	0.000	0.943		0.345	0.000	0.527	0.789	I		0.000	0.146	0.605			
Lentini (12)	0.033	0.074	0.031	0.141	0.066	0.136	0.000	0.713		0.482	0.017	0.508	T	0.789		0.007	0.103	0.887			
(9) sinolusX	0.381	0.026	0.009	0.061	0.385	0.482	0.009	0.382		0.758	0.007	ı	0.508	0.527		0.003	Kaul	0.702			
(91) ธะอา่าอราช (16)	0.000	0.073	0.063	0.037	0.000	0.002	0.000	0.000		0.021		0.007	0.017	0.000		0.976	*	*			
Ротагісо Уессһіо (7)	0.678	0.021	0.003	0.048	0.985	0.548	0.025	0.261		ı	0.021	0.758	0.482	0.345		0.002	*	*			
Monte Irsi (2)	0.071	0.001	0.000	0.005	0.081	0.700	0.523	0.009		0.183	0.002	0.100	0.101	0.011		0.000	*	*			
Incoronata (12)	0.005	0.002	0.000	0.003	0.004	0.048	0.000			0.261	0.000	0.382	Incor	0.943		0.000	*	*			
strgivəN aqqoD	0.000	0.000	0.000	0.000	0.002	0.464		0.000		0.025	0.000	0.009	0.000	0.000		0.000	*	*			
Termitito (3)	0.387	0.002	0.000	0.009	0.579		0.464	0.048		0.548	0.002	0.482	0.136	0.074		0.000	*	*			
Torre Mordillo (34)	0.814	0.000	0.000	0.000		0.579	0.002	0.004		0.985	0.000	0.385	0.066	0.001		0.000	*	*			
(91) sonsT a nobissoq	0.000	0.610	0.310	•	0.000	0.009	0.000	0.003		0.048	0.037	0.061	0.141	0.004		0.028	0.116	0.164			
(09) əqossaX	0.000	0.621	•	0.310	0.000	0.000	0.000	0.000		0.003	0.063	0.009	Kass	0.000		0.036	0.045	0.018			
Kabiren bei Theben (22)	0.000	ı	0.621	0.610	0.000	0.002	0.000	0.002		0.021	0.073	0.026	0.074	0.000		0.045	0.081	0.058			
(68) senaseX		0.000	0.000	0.000	0.814	0.387	0.000	0.005		0.678	0.000	0.381	0.033	0.000		0.000	0.346	0.028			
	Kastanas	Kabiren bei Theben	Kassope	Poseidon a Tenos	Torre Mordillo	Termitito	Coppa Nevigata	Incoronata	Monte Irsi	Pomarico Vecchio	Roccagloriosa	Kaulonia	Lentini	Eraclea Lucana	Locri Epizephiri	Pantanello Sanctuary	Pharos	Resnik	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana

The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. Those sites for which no test was run (as between a southern Italian Greek colony and a Table D.10: Results of Mann-Whitney U tests conducted on LSI values of distal breadth (Bd) of Bos taurus elements from all sites. were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Dalmatian indigenous site) are marked with an asterisk (*).

(1) ankovana (1)																					
Gradina Rat IA (1)																				1	
Gradina Rat LBA (1)																			ı		
Resnik (2)																		•			
Pharos (2)																	ı				
Pantanello Sanctuary (35)	0.000	0.009	0.001	0.001	0.000		0.000	0.000	0.003		0.005			0.035							
(1) irinqəziqB irəol															ı						
Eraclea Lucana	0.002	0.067	0.562	0.067	0.000		0.000	0.067	0.024		0.257			1		0.035					
Lentini (2)													ī								
(2) sinolusX												ı									
(4) Roccagloriosa (4)	0.187	0.686	0.011	1.000	0.004		0.012	0.684	0.114		ı			0.257		0.005					
О) опатісо Уессһіо (0)																					
Monte Irsi (3)	0.146	0.114	0.000	0.167	1.000		0.787	0.051	ı		0.114			0.024		0.003					
Incoronata (12)	0.013	1.000	0.001	0.820	0.000		0.000		0.051		0.684			0.067		0.000					
Coppa Nevigata	0.004	0.003	0.000	0.001	0.668		ı	0.000	0.787		0.012			0.000		0.000					
Termitito (1)																					
Torre Mordillo (10)	0.005	0.002	0.000	0.000		ı	0.668	0.000	1.000		0.004			0.000		0.000					
(d) sons a Tenos (d)	0.101	0.610	0.000		0.000		0.001	0.820	0.167		1.000			0.067		0.001					
(36) sqoree (36)	0.000	0.003		0.000	0.000		0.000	0.001	0.000		0.011			0.562		0.001					
Kabiren bei Theben (4)	0.123		0.003	0.610	0.002		0.003	1.000	0.114		0.686			0.067		0.009					
(74) seneseX		0.123	0.000	0.101	0.005		0.004	0.013	0.146		0.187			0.002		0.000					
	Kastanas	Kabiren bei Theben	Kassope	Poseidon a Tenos	Torre Mordillo	Termitito	Coppa Nevigata	Incoronata	Monte Irsi	Pomarico Vecchio	Roccagloriosa	Kaulonia	Lentini	Eraclea Lucana	Locri Epizephiri	Pantanello Sanctuary	Pharos	Resnik	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana

The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. Those sites for which no test was run (as between a southern Italian Greek colony and a Table D.11: Results of Mann-Whitney U tests conducted on LSI values of distal depth (Dd) of Bos taurus elements from all sites. were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Dalmatian indigenous site) are marked with an asterisk (*).

D.2 Statistical Test Results for *Ovis aries*

snavodan Spila Nakovana	0.024	0.000	0.045	0.000	0.000		*	*	*	*		*	*	*			0.781		0.151	0.389	,
Gradina Rat IA	0.610	0.029	0.785	0.036	0.008		*	*	*	*		*	*	*			0.604		0.945		0.389
A&I tag nibrid	0.562	0.001	0.784	0.002	0.000		*	*	*	*		*	*	*			0.604		ı	0.945	0.151
Resnik (2)							*	*	*	*		*									
Pharos	0.272	0.000	0.235	0.000	0.000		*	*	*	*		*	0.001	0.002			,		0.604	0.604	0.781
Pantanello Sanctuary (1																					
Locri Epizephiri (1)															ı						
Eraclea Lucana	0.256	0.812	0.119	0.359	0.919		0.000	0.000	0.000			0.753	0.519	ı			0.002		*	*	*
iniinə.J	0.377	0.148	0.084	0.087	0.150		0.000	0.000	0.000			0.269		0.519			0.001		*	*	*
Roccagloriosa	0.476	0.973	0.202	0.831	0.777		0.003	0.057	0.002	0.057			0.269	0.753			*		*	*	*
Pomarico Vecchio (2)																					
Incoronata (3)	0.167	0.004	0.189	0.010	0.003		1.000	1.000	0.969	,		0.057	0.005	0.011			*		*	*	*
Coppa Nevigata	0.017	0.000	0.018	0.000	0.000		0.915	0.515		0.969		0.002	0.000	0.000			*		*	*	*
Termitito	0.010	0.000	0.023	0.000	0.000		0.414	ı	0.515	1.000		0.057	0.000	0.001			*		*	*	*
Torre Mordillo	0.012	0.000	0.025	0.000	0.000			0.414	0.915	1.000		0.003	0.000	0.000			*		*	*	*
(1) sonsT a nobissoq															ı						
sqosseX	0.123	0.772	0.041	0.310			0.000	0.000	0.000	0.003		0.777	0.150	0.919			0.000		0.000	0.000	0.000
Kabiren bei Theben	0.065	0.143	0.012	,	0.310		0.000	0.000	0.000	0.010		0.831	0.087	0.359			0.002		0.002	0.036	0.000
Herakleion de Thasos	0.898	0.039		0.012	0.041		0.025	0.023	0.000	0.189		0.202	0.084	0.119			0.235		0.784	0.785	0.045
Kastanas	0.151		0.039	0.143	0.772		0.000	0.000	0.000	0.004		0.973	0.148	0.812			0.000		0.001	0.029	0.000
siqmyIO noisimənA	,	0.151	0.898	0.065	0.123		0.012	0.010	0.017	0.167		0.476	0.377	0.256			0.272		0.562	0.610	0.024
	Artemision Olympia	Kastanas	Herakleion de Thasos	Kabiren bei Theben	Kassope	Poseidon a Tenos	Torre Mordillo	Termitito	Coppa Nevigata	Incoronata	Pomarico Vecchio	Roccagloriosa	Lentini	Eraclea Lucana	Locri Epizaphiri	Pantanello Sanctuary	Pharos	Resnik	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana

measured for each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Table D.12: Results of Mann-Whitney U tests conducted on height estimates (WRH) of Ovis aries from all sites. The number of bones Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. Those sites for which no test was run (as between a southern Italian Greek colony and a Dalmatian indigenous site) are marked with an asterisk (*).

	nin anna anna										
	Pharos	0.296	0.218	0.100	*	*	0.262	0.	700	1	I
Table D.13:]	Results of Mann-Whitn	ey U test	s perfor	med on tr	ochlear bre	eadths of	humerus (B	T) of <i>Ov</i>	is aries	. The nu	- mber of bone:
measured for	each site is given in p	urenthese	s. Any	site for w	hich only	three or f	our measur	es were	availabl	e were s	ubjected to the
Mann-Whitne	ey U test, although these	findings	s are not	as rigoroi	us as for te	sts with a	greater nui	nber of s	amples.	Any site	with only one
or two measu	tres, or two sites with le	ss than f	ive mea	sures each	were not	tested and	d have been	left blan	ık. The	null hyp	othesis for this
test being tha	it the distribution of height	ght estim	ates was	s the same	across bo	th sites, th	nose sites w	ith statist	ically s	ignifican	t p-values have
been highligh	nted. Those sites for wh	ich no te	st was r	un (as bet	ween a soi	uthern Ital	lian Greek d	colony an	id a Dal	matian i	ndigenous site
are marked w	ith an asterisk (*).										

Pharos (3)	0.296	0.218	0.100		*	*		0.262		0.700		1
Spila Nakovana (2)											ı	
Gradina Rat IA (3)	0.004	0.005	0.100		*	*		*		I		0.700
(2) Žkrip (2)									ı			
Eraclea Lucana (6)	0.898	0.911	0.024		0.026	0.029		ı		*		0.262
(1) sinolusX							ı					
(8) ollibroM ərroT	0.000	0.000	0.012		0.282	I		0.029		*		*
(d) Revigata (d)	0.012	0.003	0.024		ı	0.282		0.026		*		*
Poseidon a Tenos (1)				ı								
Kabiren bei Theben (3)	0.004	0.000	ı		0.024	0.012		0.024		0.100		0.100
(14) senerer (41)	0.528		0.000		0.003	0.000		0.911		0.005		0.218
Artemision Olympia (13	1	0.528	0.004		0.012	0.000		0.898		0.004		0.296
	Artemision Olympia	Kastanas	Kabiren bei Theben	Poseidon a Tenos	Coppa Nevigata	Torre Mordillo	Kaulonia	Eraclea Lucana	Škrip	Gradina Rat IA	Spila Nakovana	Pharos

Resnik (2)																	ı
(4) anavodan (4)	0.837	0.262	0.762	0.343												I	
Gradina Rat IA (3)	0.045	0.005	0.048	0.057											I		
Gradina Rat LBA (4)	0.014	0.001	0.019	0.029										ı			
Eraclea Lucana (4)	0.022	0.736	0.114	0.486	0.020	0.343		0.006		0.400	0.400		ı				
Pantanello Sanctuary (1)												ı					
Ротатісо Уессћіо (3)	0.251	0.574	0.905		0.136	0.857		0.017		0.700	ı		0.400				
Roccagloriosa (3)	0.281	0.426	0.905	0.857	0.136	0.857		0.017		ı	0.700		0.400				
Incoronata (1)									ı								
Torre Mordillo (7)	0.010	0.000	0.008	0.006	0.227	0.109		ı		0.017	0.017		0.006				
Termitito (1)							ı										
Monte Irsi (4)	0.576	0.185	0.914	0.868	0.316	ı		0.109		0.857	0.857		0.343				
Coppa Nevigata (12)	0.137	0.001	0.102	0.058	I	0.058		0.227		0.136	0.136		0.020				
(4) əqossaX	0.071	0.411	0.476	I	0.058	0.686		0.006		0.857			0.486	0.029	0.057	0.343	
Kabiren bei Theben (6)	0.224	0.132	ı	0.476	0.102	0.914		0.008		0.905	0.905		0.114	0.019	0.048	0.762	
Herakleion de Thasos (15)	0.001	ı	0.132	0.411	0.001	0.185		0.000		0.426	0.574		0.736	0.001	0.005	0.262	
Kastanas (26)	ı	0.001	0.224	0.071	0.137	0.576		0.010		0.281	0.251		0.022	0.014	0.045	0.837	
	Kastanas	Herakleion de Thasos	Kabiren bei Theben	Kassope	Coppa Nevigata	Monte Irsi	Termitito	Torre Mordillo	Incoronata	Roccagloriosa	Pomarico Vecchio	Pantanello Sanctuary	Eraclea Lucana	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana	Resnik

Table D.14: Results of Mann-Whitney U tests performed on proximal breadths of metacarpal (Bp) of Ovis aries. The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted.

Resnik (2)		0.221	0.571	0.548	0.400										
Spila Nakovana (3)		0.000	0.016	0.010	0.144							0.517		ı	
Gradina Rat IA (4)												0.006	ı		
Eraclea Lucana (7)		0.976	0.755	0.534	0.833	0.073						1	0.006	0.517	
Pantanello Sanctuary (2)											ı				
Pomarico Vecchio (1)										ı					
Torre Mordillo (2)									ı						
Termitito (2)								1							
Monte Irsi (1)															
Coppa Nevigata (5)		0.019	0.056	0.052	0.786	ı						0.073			
Kassope (3)		0.740		1.000	ı	0.786						0.833	0.144	0.400	
Kabiren bei Theben (6)		0.494	0.662	ı	1.000	0.052						0.534	0.010	0.548	
Herakleion de Thasos (5)		0.745	•	0.662		0.056						0.755	0.016	0.571	
(91) senerseX		ı	0.745	0.494	0.740	0.019						0.976	0.000	0.221	
Artemision Olympia (2)	ı														
	Artemision Olympia	Kastanas	Herakleion de Thasos	Kabiren bei Theben	Kassope	Coppa Nevigata	Monte Irsi	Termitito	Torre Mordillo	Pomarico Vecchio	Pantanello Sanctuary	Eraclea Lucana	Gradina Rat IA	Spila Nakovana	Resnik

Table D.15: Results of Mann-Whitney U tests performed on proximal breadths of radius (Bp) of Ovis aries. The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted.

]			
(4) Resnik (4)	0.003		0.095	0.857				*	0.570	0.029	0.935			0.114		ı	ı
Pharos (1)		0.114													ı		
(1) snsvoana (1)														ı			
Gradina Rat IA (4)	0.571		0.177	0.114		0.710		*	*	*	*		ı				0.114
Gradina Rat LBA (1)		0.343			0.229							ı					
(1) qindž																	0.935
Eraclea Lucana (12)	0.003		0.034	0.633		0.000		0.000	0.734	0.170	0.170			*			0.029
(4) Kaulonia (4)	0.177	0.212	0.900	0.057	0.945	0.006		0.000	0.808					*			0.570
(8) initial	0.109	0.886	0.433	0.497	0.629	0.006		0.000	ı	0.808	0.734			*			*
Torre Mordillo (21)	0.000	0.808	0.000	0.001	0.776	0.422			0.000	0.000	0.000			*			
Monte Irsi (1)	0.002	0.001	0.368	0.009	0.004			0.422	0.006	0.006	0.000			0.710			0.003
Coppa Nevigata (9)	0.368	0.006	0.089		0.018			0.004	0.776	0.629	0.945			0.229			
Kassope (3)						0.018											
Kabiren bei Theben (13)	0.011	0.857	0.961		0.857	0.009		0.001	0.497	0.057	0.633			0.114			0.857
Kastanas (84)	0.118	0.114	•	0.089	0.368	0.000		0.000	0.433	0.900	0.034			0.571			0.003
Herakleion de Thasos (14)	0.226	•	0.011	0.114		0.006		0.001	0.808	0.886	0.212			0.343			0.114
(11) siqmylO noisimətıA		0.226	0.118	0.011	0.368	0.002		0.000	0.109	0.177	0.003			0.571			0.003
	Artemision Olympia	Herakleion de Thasos	Kastanas	Kabiren bei Theben	Kassope	Coppa Nevigata	Monte Irsi	Torre Mordillo	Lentini	Kaulonia	Eraclea Lucana	Škrip	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana	Pharos	Resnik

Table D.16: Results of Mann-Whitney U tests performed on distal breadths of tibia (Bd) of Ovis aries. The number of bones measured or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the Those sites for which no test was run (as between a southern Italian Greek colony and a Dalmatian indigenous site) are marked with an for each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. asterisk (*).
	0.004												
Resnik (4)		-	0.343	0.629	*		*	0.683	0.486	0.785	0.029		I
(1) anavodana (1)	0.635	0.421					*					1	
Gradina Rat IA (4)	0.635		0.029	0.057	*		*	*	*	*	0.400		0.029
Gradina Rat LBA (1)			0.886								I		
Eraclea Lucana (13)	0.000	0.092	0.245	0.900	0.000		0.000	0.595	0.202	ı			0.785
(4) ainoluaX	0.142	0.744		0.057	0.050		0.004	0.683	ı	0.202	*		0.486
(8) initnə.	0.002	0.630	0.570	0.630	0.000		0.000	1	0.683	0.595	*		0.683
Torre Mordillo (21)	0.001	0.000	0.000	0.001	0.094		1	0.000	0.000	0.000	*		*
(1) isrl ətnoM						•							
(9) atagivəN aqqoD	0.133	0.000	0.003	0.009			0.094	0.000	0.050	0.000	*		*
Kabiren bei Theben (3)	0.007	0.223	0.229		0.009		0.001	0.630	0.057	0.900	0.057		0.629
Herakleion de Thasos (4)	0.008	0.866		0.229	0.003		0.000	0.570	0.886	0.245	0.029		0.343
Kastanas (83)	0.004	ı	0.866	0.223	0.000		0.000	0.630	0.744	0.092	0.015		0.421
(01) siqmyIO noisimətıA		0.004	0.008	0.007	0.133		0.001	0.002	0.142	0.000	0.635		0.004
	Artemision Olympia	Kastanas	Herakleion de Thasos	Kabiren bei Theben	Coppa Nevigata	Monte Irsi	Torre Mordillo	Lentini	Kaulonia	Eraclea Lucana	Gradina Rat IA	Spila Nakovana	Resnik

Table D.17: Results of Mann-Whitney U tests performed on distal depths of tibia (Dd) of *Ovis aries*. The number of bones measured for or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the Those sites for which no test was run (as between a southern Italian Greek colony and a Dalmatian indigenous site) are marked with an each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. asterisk (*).

Resnik (4)	0.393	0.105	0.905	0.383	0.017			0.057				0.100	0.229		I
Pharos (1)														ı	
(4) anavodana (4)	0.413	0.459	0.171	0.412	0.412			0.486				0.299			0.229
Gradina Rat IA (3)	0.036	0.000	0.024	0.017	0.667			0.629				ı	0.400		0.100
Gradina Rat LBA (1)											ı				
Eraclea Lucana (1)										I					
Incoronata (2)									ı						
Torre Mordillo (4)	0.016	0.000	0.010	0.006	0.788			1				0.629	0.486		
Termitito (1)							1								0.057
(1) isrl ətnoM						ı									
(7) atagivəN aqqoD	0.005	0.000	0.001	0.001	ı			0.788				0.667	0.412		0.017
Kassope (7)	0.935	0.171	0.836	ı	0.001			0.006				0.017	0.412		0.383
Kabiren bei Theben (6)	0.429	0.257	ı	0.836	0.001			0.010				0.024	0.171		0.905
Herakleion de Thasos (5)	0.609		0.257	0.171	0.000			0.000				0.000	0.459		0.105
(82) senerseX	ı	0.609	0.429	0.935	0.005			0.016				0.036	0.413		0.393
	Herakleion de Thasos	Kastanas	Kabiren bei Theben	Kassope	Coppa Nevigata	Monte Irsi	Termitito	Torre Mordillo	Incoronata	Eraclea Lucana	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana	Pharos	Resnik

Table D.18: Results of Mann-Whitney U tests performed on proximal breadths of metatarsal (Bp) of Ovis aries. The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted.

Resnik (3)		0.015	0.250			*		*			0.001						0.018		ı
Pharos (3)		0.377	0.250			*		*			0.380						0.926	I	
(9) ankovana (9)	0.282	0.161	0.083		0.373	*		*			*		*		0.864	0.864	•	0.926	0.018
Gradina Rat IA (3)		0.318	0.071			*		*			*		*			ı	0.864		
Gradina Rat LBA (3)		0.292	0.250			*		*			*		*		ı		0.864		
Škrip (1)														ı					
Eraclea Lucana (3)		0.549	0.786			0.025		0.009			0.289		I		*	*	*		
Pantanello Sanctuary (1)												I							
Lentini (31)	0.214	0.648	0.396		0.645	0.000		0.000			I		0.289		*	*	*	0.380	0.001
Roccagloriosa (2)										I									
Pomarico Vecchio (2)									ı										
Torre Mordillo (9)	0.009	0.000	0.001		0.100	0.471		ı			0.000		0.009		*	*	*	*	*
Termitito (2)							ı												
Coppa Nevigata (13)	0.025	0.000	0.007		0.057	•		0.471			0.000		0.025		*	*	*	*	*
(3) sqossed		0.829	0.881		ı	0.057		0.100			0.645						0.373		
(1) sonsT a nobissoq				ı															
(S) nədən Theben (S)	0.786	0.399	•		0.881	0.007		0.001			0.396		0.786		0.250	0.071	0.083	0.250	0.250
Kastanas (34)	0.476	•	0.399		0.829	0.000		0.000			0.648		0.549		0.292	0.318	0.161	0.377	0.015
(E) siqmyIO noisimərA	1	0.476	0.786			0.025		0.009			0.214						0.282		
	Artemision Olympia	Kastanas	Kabiren bei Theben	Poseidon a Tenos	Kassope	Coppa Nevigata	Termitito	Torre Mordillo	Pomarico Vecchio	Roccagloriosa	Lentini	Pantanello Sanctuary	Eraclea Lucana	Škrip	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana	Pharos	Resnik

Table D.19: Results of Mann-Whitney U tests performed on astragalus lengths (Gl) of Ovis aries. The number of bones measured for test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the Those sites for which no test was run (as between a southern Italian Greek colony and a Dalmatian indigenous site) are marked with an each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Mann-Whitney U distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. asterisk (*).

Resnik (3)		0.883	0.881							0.808								ı
Pharos (3)		0.571	0.393							0.164							I	
Spila Nakovana (2)		0.968	0.857													ı		
Gradina Rat IA (3)		0.416	0.393												ı			
Gradina Rat LBA (3)		0.087	0.071											ı				
Škrip (2)													ı					
Eraclea Lucana (3)		0.382	0.786			0.014		0.009		0.419		ı		*	*	*		
Pantanello Sanctuary (1)											ı							
(62) initns.L	0.275	0.453	0.851		0.669	0.000		0.000		ı		0.419		*	*	*	0.164	0.808
Pomarico Vecchio (2)									ı									
Torre Mordillo (9)	0.036	0.001	0.002		0.145	0.720		1		0.000		0.009		*	*	*	*	*
Termitito (2)							ı											
(01) atagivəN aqqoD	0.061	0.000	0.005		0.049	I		0.720		0.000		0.014		*	*	*	*	*
Kassope (3)		0.657	0.657		ı	0.049		0.145		0.669								
(1) sonsT a nobissoq				ı														
Kabiren bei Theben (5)	0.857	0.421	ı		0.657	0.005		0.002		0.851		0.786		0.071	0.393	0.857	0.393	0.881
(05) senatseX	0.258	ī	0.421		0.657	0.000		0.001		0.453		0.382		0.087	0.416	0.968	0.571	0.883
(2) aiqmyIO noisimətrA	ı	0.258	0.857			0.061		0.036		0.275								
	Artemision Olympia	Kastanas	Kabiren bei Theben	Poseidon a Tenos	Kassope	Coppa Nevigata	Termitito	Torre Mordillo	Pomarico Vecchio	Lentini	Pantanello Sanctuary	Eraclea Lucana	Škrip	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana	Pharos	Resnik

Table D.20: Results of Mann-Whitney U tests performed on astragalus breadths (Bd) of Ovis aries. The number of bones measured for test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Mann-Whitney U Those sites for which no test was run (as between a southern Italian Greek colony and a Dalmatian indigenous site) are marked with an distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. asterisk (*)

Resnik (2)	0.013	0.190		*	*		0.028					0.036		I
Pharos (3)	0.202 (0.393		*	*		0.256					0.600	,	
(9) anavodana (9)	0.105	0.298		*	*		*	*		0.864	0.864	•	0.600	0.036
Gradina Rat IA (3)	0.105	0.250		*	*		*	*				0.864		
Gradina Rat LBA (3)	0.004	0.036		*	*		*	*		1		0.864		
(1) qindŽ									ı					
Eraclea Lucana (1)	0.761	0.575												
Lentini (28)				0.016	0.047		ı			*	*	*	0.256	0.028
Roccagloriosa (2)	0.033	0.247	0.777			ı								
Torre Mordillo (6)	0.018	0.129	0.262	0.635	1		0.047			*	*	*	*	*
Coppa Nevigata (10)	0.937	0.881	0.371	•	0.635		0.016			*	*	*	*	*
Kassope (3)			ı	0.371	0.262		0.777							
Kabiren bei Theben (5)	0.760	,	0.881	0.129	0.247		0.575			0.036	0.250	0.298	0.393	0.190
Kastanas (35)	•	0.760	0.937	0.018	0.033		0.761			0.004	0.105	0.105	0.202	0.013
	Kastanas	Kabiren bei Theben	Kassope	Coppa Nevigata	Torre Mordillo	Roccagloriosa	Lentini	Eraclea Lucana	Škrip	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana	Pharos	Resnik

Table D.21: Results of Mann-Whitney U tests performed on astragalus depths (DI) of Ovis aries. The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Mann-Whitney U or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, Those sites for which no test was run (as between a southern Italian Greek colony and a Dalmatian indigenous site) are marked with an distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. asterisk (*).

Resnik (1)													ı
Pharos (2)												ı	
(9) snavodana (9)	0.453		0.373	*				*	0.235	0.682	ı		
Gradina Rat IA (15)	0.039		0.164	*				*	0.821		0.682		
Gradina Rat LBA (13)	0.000		0.082	*				*	ı	0.821	0.235		
Eraclea Lucana (11)	0.440		0.659	0.001				ı	*	*	*		
(2) initnə.							ı		*	*	*		
(1) sinolusX						ı							
Pomarico Vecchio (1)					ı								
Torre Mordillo (10)	0.000		0.077	1				0.001	*	*	*		
Kassope (3)	0.497		ı	0.077				0.659	0.082	0.164	0.373		
Poseidon a Tenos (1)		1											
Kastanas (22)	I		0.497	0.000				0.440	0.000	0.039	0.453		
	Kastanas	Poseidon a Tenos	Kassope	Torre Mordillo	Pomarico Vecchio	Kaulonia	Lentini	Eraclea Lucana	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana	Pharos	Resnik

Table D.22: Results of Mann-Whitney U tests performed on lengths of first phalanx (GLpe) of Ovis aries. The number of bones measured or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the for each site is given in parentheses. Any site for which only three or four measures were available were subjected to the Mann-Whitney Those sites for which no test was run (as between a southern Italian Greek colony and a Dalmatian indigenous site) are marked with an U test, although these findings are not as rigorous as for tests with a greater number of samples. Any site with only one or two measures, distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. asterisk (*).

Spila Nakovana (24)	0.000	0.000	0.015	0.491	0.000		*	*	*	*		*				*	*			0.000	0.313	0.332	0.435	
Gradina Rat IA (22)	0.000	0.000	0.017	0.064	0.000		*	*	*	*		*				*	*			0.000	0.320	0.823		0.435
Gradina Rat LBA (25)	0.000	0.000	0.014	0.460	0.000		*	*	*	*		*				*	*			0.000	0.310	1	0.823	0.332
(8) Xinzs (8)	0.081	0.052	0.157	0.633	0.048		*	*	*	*		*				0.013	0.043			0.003		0.310	0.320	0.313
Pharos (11)	0.078	0.000	0.069	0.002	0.028		*	*	*	*		*				0.003	0.003				0.003	0.000	0.000	0.000
Pantanello Sanctuary (1)																			1					
Locri Epizephiri (2)																								
Eraclea Lucana (23)	0.773	0.302	0.932	0.187	0.531		0.001	0.011	0.000	0.009		0.032				0.750				0.003	0.043	*	*	*
Lentini (35)	0.843	0.093	0.826	0.093	0.572		0.000	0.001	0.000	0.004		0.013					0.750			0.003	0.013	*	*	*
(1) ainolua X																						*	*	*
Roccagloriosa (2)																				*	*	*	*	*
Pomarico Vecchio (3)	0.048	0.098	0.223	0.573	0.078		0.014	0.057	0.005	0.024						0.013	0.032			*	*	*	*	*
Monte Irsi (0)											,									*	*	*	*	*
Incoronata (6)	0.065	0.002	0.067	0.003	0.041		0.701	0.762	1.000			0.024				0.004	0.00			*	*	*	*	*
Coppa Nevigata (23)	0.00	0.000	0.00	0.000	0.002		0.697	0.73	1	1.000		0.005				0.000	0.000			*	*	*	*	*
(4) Termitito (4)	0.010	0.003	0.042	0.004	0.041		0.703	•	0.921	0.762		0.057				0.001	0.011			*	*	*	*	*
Torre Mordillo (13)	0.005	0.000	0.008	0.000	0.004		ı	0.703	0.697	0.701		0.014				0.000	0.001			*	*	*	*	*
Poseidon a Tenos (2)						•																		
Kassope (23)	0.813	0.084	0.797	960.0	'		0.004	0.041	0.002	0.041		0.078				0.572	0.531			0.028	0.048	0.000	0.000	0.000
Kabiren bei Theben (10)	0.263	0.262	0.254	ı	0.096		0.000	0.004	0.000	0.003		0.573				0.093	0.187			0.002	0.633	0.460	0.064	0.491
Herakleion de Thasos (12)	1.000	0.502	'	0.254	0.797		0.008	0.042	0.009	0.067		0.223				0.826	0.932			0.069	0.157	0.014	0.017	0.015
Kastanas (101)	0.405	'	0.502	0.262	0.084		0.000	0.003	0.000	0.002		0.098				0.093	0.302			0.000	0.052	0.000	0.000	0.000
(6) siqmyIO noisimərıA	1	0.405	1.000	0.263	0.813		0.005	0.010	0.009	0.065		0.048				0.843	0.773			0.078	0.081	0.000	0.000	0.000
	Artemision Olympia	Kastanas	Herakleion de Thasos	Kabiren bei Theben	Kassope	Poseidon a Tenos	Torre Mordillo	Termitito	Coppa Nevi- gata	Incoronata	Monte Irsi	Pomarico	Vecchio	Roccagloriosa	Kaulonia	Lentini	Eraclea Lucana	Locri Epizephiri	Pantanello Sanctuary	Pharos	Resnik	Gradina Rat LBA	Gradina Rat IA	Spila Nako- vana

The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. Those sites for which no test was run (as between a southern Italian Greek colony and a Table D.23: Results of Mann-Whitney U tests conducted on LSI values of greatest length (GL) of Ovis aries elements from all sites. were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Dalmatian indigenous site) are marked with an asterisk (*).

(25) antevorana (25)	1.000	0.583	0.091	0.638	0.195		*	*	*	*	*	*	*		*	*		*	0000	0.000	1.000	0.036	0.139	
Gradina Rat IA (35)	1.000	0.578	0.065	0.610	0.185		*	*	*	*	*	*	*		*	*		*	0000	0.000	1.000	0.692	ı	0.139
Gradina Rat LBA (32)	1.000	0.606	0.071	0.617	0.201		*	*	*	*	*	*	*		*	*		*	0000	0.000	1.000	·	0.692	0.036
Resnik (14)	0.721	0.907	0.762	0.585	0.675		*	*	*	*	*	*	*		0.042	0.914		1.000		020.0	•	1.000	1.000	1.000
Pharos (6)	0.038	0.018	0.018	0.003	0.071		*	*	*	*	*	*	*		0.063	0.002		0.048			0.020	0.000	0.000	0.000
Pantanello Sanctuary (3)	0.629	0.846	0.930	0.866	0.733		0.014	0.033	0.007	0.048	0.548	0.376	1.000		0.220	0.934				0.048	1.000	*	*	*
Locri Epizephiri (1)																	1							
Eraclea Lucana (32)	0.942	0.561	0.637	0.754	0.273		0.000	0.001	0.000	0.000	0.245	0.561	0.676		0.002			0.934		0.002	0.914	*	*	*
Lentini (32)	0.170	0.00	0.003	0.003	0.147		0.000	0.025	0.000	0.004	0.864	0.002	0.077		ı	0.002		0.220		0.005	0.042	*	*	*
(1) sinolusX																								
Roccagloriosa (3)	0.629	0.654	0.977	1.000	0.542		0.009	0.033	0.007	0.018	0.381	1.000			0.077	0.676		1.000		ę	*	*	*	*
Ροmarico Vecchio (8)	0.283	0.361	0.739	0.735	0.199		0.000	0.000	0.000	0.000	0.282		1.000		0.002	0.561		0.376		¢	*	*	*	*
Monte Irsi (6)	0.476	0.185	0.233	0.107	0.404		0.176	0.445	0.134	0.291		0.282	0.381		0.864	0.245		0.548	-	é .	*	*	*	*
Incoronata (12)	0.013	0.000	0.001	0.000	0.002		0.269	0.773	0.308		0.291	0.000	0.018		0.004	0.000		0.048	÷	¢	*	*	*	*
(64) atagivəN aqqoD	0.006	0.000	0.000	0.000	0.000		0.658	0.184		0.308	0.134	0.000	0.007		0.000	0.000		0.007	÷	ę	*	*	*	*
Termitito (7)	0.024	0.006	0.010	0.001	0.017		0.083	•	0.184	0.773	0.445	0.009	0.033		0.025	0.001		0.033		¢	*	*	*	*
(91) ollibroM srroT	0.004	0.000	0.000	0.000	0.000		ı	0.083	0.658	0.269	0.176	0.000	0.000		0.000	0.000		0.014	÷	ę	*	*	*	*
Poseidon a Tenos (2)																								
(42) stassed (34)	0.663	0.440	0.316	0.221			0.000	0.017	0.000	0.002	0.404	0.199	0.542		0.147	0.273		0.733		0.0/1	0.675	0.201	0.185	0.195
Kabiren bei Theben (26)	0.746	0.353	0.831		0.221		0.000	0.001	0.000	0.000	0.107	0.735	1.000		0.003	0.754		0.866		0.005	0.585	0.617	0.610	0.638
Herakleion de Thasos (30)	0.588	0.621	•	0.831	0.316		0.000	0.010	0.000	0.001	0.233	0.739	0.977		0.003	0.637		0.930		0.018	0.762	0.071	0.065	0.091
Kastanas (163)	0.983	,	0.621	0.353	0.440		0.000	0.006	0.000	0.000	0.185	0.361	0.654		0.009	0.561		0.846		0.018	0.907	0.606	0.578	0.583
(4) siqmyIO noisimstrA		0.983	0.588	0.746	0.663		0.004	0.024	0.006	0.013	0.476	0.283	0.629		0.170	0.942		0.629		0.038	0.721	1.000	1.000	1.000
	Artemision	Kastanas	Herakleion de Thasos	Kabiren bei Theben	Kassope	Poseidon a Tenos	Torre Mordillo	Termitito	Coppa Nevigata	Incoronata	Monte Irsi	Pomarico Vecchio	Roccaglorio	Kaulonia	Lentini	Eraclea Lucana	Locri Epizephiri	Pantanello	Sanctuary	Pharos	Resnik	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana

significant p-values have been highlighted. Those sites for which no test was run (as between a southern Italian Greek colony and a The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically Table D.24: Results of Mann-Whitney U tests conducted on LSI values of proximal breadth (Bp) of Ovis aries elements from all sites. were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Dalmatian indigenous site) are marked with an asterisk (*).

Spila Nakovana (22)		0.022	0.003	0.000	0.016		*	*	*	*	*				*	*			0.001	0.006	0.036	0.180	ī
Gradina Rat IA (13)		0.075	0.002	0.001	0.030		*	*	*	*	*				*	*			0.004	0.015	0.134	•	0.180
Gradina Rat LBA (11)		0.101	0.004	0.001	0.038		*	*	*	*	*				*	*			0.005	0.020		0.134	0.036
Resnik (10)		0.005	0.377	0.005	0.035		*	*	*	*	*				0.010	0.160			0.028	ı	0.020	0.015	0.006
Pharos (3)		0.158	0.004	0.573	0.727		*	*	*	*	*				0.256	0.017				0.028	0.005	0.004	0.001
Pantanello Sanctuary (2)																		ı					
Locri Epizephiri (0)																	ı						
Eraclea Lucana (15)		0.022	0.476	0.012	0.073		0.000	0.001	0.000	0.007	0.230				0.002	,			0.017	0.160	*	*	*
(82) iniîns		0.335	0.000	0.257	0.794		0.000	0.058	0.000	0.062	0.448				-	0.002			0.256	0.010	*	*	*
(0) sinolusX														ı									
Roccagloriosa (2)													1										
Pomarico Vecchio (0)												ī											
Monte Irsi (5)		0.967	0.057	0.513	0.797		0.042	0.151	0.144	0.518	ı				0.448	0.230			*	*	*	*	*
(9) Incoronata		0.023	0.000	0.447	0.297		0.730	0.606	0.849	ı	0.518				0.062	0.007			*	*	*	*	*
(75) sisgivəN aqqoD		0.000	0.000	0.151	0.081		0.567	0.362	ı	0.849	0.144				0.000	0.000			*	*	*	*	*
Termitito (5)		0.081	0.001	1.000	0.438		0.112	-	0.362	0.606	0.151				0.058	0.001			*	*	*	*	*
(9) Torre Mordillo (9)		0.000	0.000	0.065	0.063		ı	0.112	0.567	0.730	0.042				0.000	0.000			*	*	*	*	*
(0) sonsT a nobissoq																							
(9) sqosseX		0.494	0.015	0.780	-		0.063	0.438	0.081	0.297	0.797				0.794	0.073			0.727	0.035	0.038	0.030	0.016
Kabiren bei Theben (10)		0.165	0.001	ı	0.780		0.065	1.000	0.151	0.447	0.513				0.257	0.012			0.573	0.005	0.001	0.001	0.000
Herakleion de Thasos (25)		0.000	1	0.001	0.015		0.000	0.001	0.000	0.000	0.057				0.000	0.476			0.004	0.377	0.004	0.002	0.003
(901) sanaseKanaseKanaseKanaseKanaseKanaseKanaseKanaseKanaseKanaseKanaseKanaseKanaseKanaseKanaseKanaseKanaseKan		,	0.000	0.165	0.494		0.000	0.081	0.000	0.023	0.967				0.335	0.022			0.158	0.005	0.101	0.075	0.022
(0) siqmyIO noisiməriA	ı																						
	Artemision Olympia	Kastanas	Herakleion de Thasos	Kabiren bei Theben	Kassope	Poseidon a Tenos	Torre Mordillo	Termitito	Coppa Nevigata	Incoronata	Monte Irsi	Pomarico Vecchio	Roccagloriosa	Kaulonia	Lentini	Eraclea Lucana	Locri Epizephiri	Pantanello Sanctuary	Pharos	Resnik	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana

The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. Those sites for which no test was run (as between a southern Italian Greek colony and a were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Table D.25: Results of Mann-Whitney U tests conducted on LSI values of proximal depth (Dp) of Ovis aries elements from all sites. Dalmatian indigenous site) are marked with an asterisk (*).

(21) anavodan (15)	0.000	000	0.003	0.139	0.144		0.273		*	*	*	*		*		*	*	*			0.005	0.466	0.472	0.283	
Gradina Rat IA (24)	0.000	0	0.000	0.089	0.086		0.201		*	*	*	*		*		*	*	*			0.001	0.357	0.336	'	0.283
Gradina Rat LBA (22)	0.000	0	0.000	0.096	0.077		0.211		*	*	*	*		*		*	*	*			0.001	0.320	•	0.336	0.472
Resnik (8)	0.343		0.506	0.709	0.762		0.492		*	*	*	*		*		0.574	0.506	0.501			0.234		0.320	0.357	0.466
Pharos (8)	0.236		0.160	0.304	0.083		0.082		*	*	*	*		*		0.038	0.506	0.021				0.234	0.001	0.001	0.005
Pantanello Sanctuary (0)																				,					
Locri Epizephiri (1)																			ı						
Eraclea Lucana (36)	0.019	000	0.009	0.130	0.969		0.913		0.000	0.000	0.000	0.020		0.823		0.534	0.081	1			0.021	0.501	*	*	*
Lentini (15)	0.927		0.681	0.657	0.216		0.145		0.000	0.011	0.001	0.789		0.213		0.238		0.081			0.506	0.506	*	*	*
(8) ainoluaX	0.154		0.152	0.281	0.965		0.912		0.000	0.001	0.000	0.177		1.000			0.238	0.534			0.038	0.574	*	*	*
Roccagloriosa (0)																									
Pomarico Vecchio (8)	0.113		0.143	0.258	0.829		0.740		0.000	0.001	0.000	0.026		1		1.000	0.213	0.823			*	*	*	*	*
Monte Irsi (1)																									
Incoronata (18)	0.562		0.270	0.613	0.064		0.020		0.000	0.001	0.000			0.026		0.177	0.789	0.020			*	*	*	*	*
Coppa Nevigata (36)	0.000	000	0.000	0.000	0.000		0.000		0.093	0.930	1	0.000		0.000		0.000	0.001	0.000			*	*	*	*	*
Termitito (6)	0.000		0.001	0.00	0.000		0.001		0.439	ı	0.930	0.001		0.001		0.001	0.011	0.000			*	*	*	*	*
Torre Mordillo (29)	0.000	0000	0.000	0.000	0.000		0.000		ı	0.439	0.093	0.000		0.000		0.000	0.000	0.000			*	*	*	*	*
Poseidon a Tenos (2)								ı																	
Kassope (23)	0.058		0.057	0.223	0.832		•		0.000	0.001	0.000	0.020		0.740		0.912	0.145	0.913			0.082	0.492	0.211	0.201	0.273
Kabiren bei Theben (10)	0.113		0.207	0.373			0.832		0.000	0.000	0.000	0.064		0.829		0.965	0.216	0.969			0.083	0.762	0.077	0.086	0.144
Herakleion de Thasos (20)	0.644		0.896	ı	0.373		0.223		0.000	0.009	0.000	0.613		0.258		0.281	0.657	0.130			0.304	0.709	0.096	0.089	0.139
Kastanas (210)	0.470		ı	0.896	0.207		0.057		0.000	0.001	0.000	0.270		0.143		0.152	0.681	0.009			0.160	0.506	0.000	0.000	0.003
(72) siqmyIO noisim9trA	,		0.470	0.644	0.113		0.058		0.000	0.000	0.000	0.562		0.113	sa	0.154	0.927	0.019			0.236	0.343	0.000	0.000	0.000
	Artemision	Olympia	Kastanas	Herakleion de Thasos	Kabiren	Del Theben	Kassope	Poseidon a Tenos	Torre Mordillo	Termitito	Coppa Nevigata	Incoronata	Monte Irsi	Pomarico Vecchio	Roccaglorio	Kaulonia	Lentini	Eraclea Lucana	Locri Epizephiri	Pantanello Sanctuary	Pharos	Resnik	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana

The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. Those sites for which no test was run (as between a southern Italian Greek colony and a Table D.26: Results of Mann-Whitney U tests conducted on LSI values of distal breadth (Bd) of Ovis aries elements from all sites. were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Dalmatian indigenous site) are marked with an asterisk (*).

(EI) anavoana (I3)	0.000	0.041	0.589	0.004			*	*	*	*				*	*	*				0.059	0.060	0.075	
Gradina Rat IA (28)	0.000	0.006	0.494	0.000			*	*	*	*				*	*	*				0.034	0.670	•	0.075
Gradina Rat LBA (24)	0.000	0.011	0.525	0.001			*	*	*	*				*	*	*				0.039		0.670	0.060
Resnik (5)	0.115	0.653	0.275	0.393			*	*	*	*				1.000	0.968	0.265					0.039	0.034	0.059
Pharos (2)																							
Pantanello Sanctuary (0)																							
Locri Epizephiri (0)																	1						
Eraclea Lucana (19)	0.002	0.324	0.403	0.857			0.000	0.021	0.000	0.022				0.534	0.271	ı				0.265	*	*	*
(01) inimoL	0.015	0.586	0.067	0.487			0.000	0.083	0.012	0.365				0.905	ı	0.271				0.968	*	*	*
(Z) sinolus (S)	0.115	0.917	0.548	0.250			0.006	0.177	0.117	0.491				,	0.905	0.534				1.000	*	*	*
Roccagloriosa (0)													1										
Pomarico Vecchio (0)												ī											
Monte Irsi (1)											ı												
Incoronata (18)	0.188	0.066	0.009	0.262			0.000	0.251	0.040	ı				0.491	0.365	0.022				*	*	*	*
Coppa Nevigata (34)	0.327	0.000	0.000	0.092			0.036	0.810		0.040				0.117	0.012	0.000				*	*	*	*
(6) Termitito (6)	0.733	0.039	0.003	0.167			0.070		0.810	0.251				0.177	0.083	0.021				*	*	*	*
(01) ollibroM 910	0.009	0.000	0.000	0.014				0.070	0.036	0.000				0.006	0.000	0.000				*	*	*	*
(0) sonsT a nobissoq						ı																	
Kassope (0)					,																		
Kabiren bei Theben (3)	0.038	0.563	0.958	•			0.014	0.167	0.092	0.262				0.250	0.487	0.857				0.393	0.001	0.000	0.004
Herakleion de Thasos (16)	0.644	0.063	1	0.958			0.000	0.003	0.000	0.009				0.548	0.067	0.403				0.275	0.525	0.494	0.589
Kastanas (145)	0.004	,	0.063	0.563			0.000	0.039	0.000	0.066				0.917	0.586	0.324				0.653	0.011	0.006	0.041
(11) siqmyIO noisimətıA	1	0.004	0.644	0.038			0.009	0.733	0.327	0.188				0.115	0.015	0.002				0.115	0.000	0.000	0.000
	Artemision Olympia	Kastanas	Herakleion de Thasos	Kabiren bei Theben	Kassope	Poseidon a Tenos	Torre Mordillo	Termitito	Coppa Nevigata	Incoronata	Monte Irsi	Pomarico Vecchio	Roccagloriosa	Kaulonia	Lentini	Eraclea Lucana	Locri Epizephiri	Pantanello Sanctuary	Pharos	Resnik	Gradina Rat LBA	Gradina Rat IA	Spila Nakovana

The number of bones measured for each site is given in parentheses. Any site for which only three or four measures were available Any site with only one or two measures, or two sites with less than five measures each were not tested and have been left blank. The null hypothesis for this test being that the distribution of height estimates was the same across both sites, those sites with statistically significant p-values have been highlighted. Those sites for which no test was run (as between a southern Italian Greek colony and a were subjected to the Mann-Whitney U test, although these findings are not as rigorous as for tests with a greater number of samples. Table D.27: Results of Mann-Whitney U tests conducted on LSI values of distal breadth (Dd) of Ovis aries elements from all sites. Dalmatian indigenous site) are marked with an asterisk (*).