CHANGING PATTERNS OF POTTERY PRODUCTION DURING THE LONGSHAN PERIOD OF NORTHERN CHINA, CA. 2500-2000 B.C.

by

Anne P. Underhill

B.A., Duke University, Durham, North Carolina, 1977

M.A., University of British Columbia, 1983

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

in

THE FACULTY OF GRADUATE STUDIES

(Department of Anthropology and Sociology)

We accept this dissertation as conforming to

the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

July 1990

45 ?

ABSTRACT

This study investigates how systems of pottery production change in relation to increasing cultural complexity. A revised version of the important model outlined by Rice (1981) is presented and tested with ceramic data from the Longshan Period of northern China. At the end of the period, at least one state evolved in the Huanghe (Yellow River) valley region.

The model describes social factors that may cause ceramic change in chiefdoms. It describes three alternative strategies of producers: diversification, simplification, and conservatism. Consumer demand for labor-intensive vessels used in displays of status may also cause changes in production. After Rice (1981), the model predicts that variety of ceramic categories should increase and that vessels should become increasingly standardized. Further, there should be a change in mode of production as sociopolitical complexity increases.

The model is tested with ceramic data from three sites in Henan (Hougang, Baiying, Meishan) and one in Shandong (Lujiakou). During a period of six months in 1987, I examined reconstructed vessels from these sites in museums and archaeological work stations located in Henan and Shandong provinces. The following analyses are described: analysis of shape classes defined in site reports (Chapter 4), diversity of shape classes, dimensional standardization, within-class standardization, and assessment of labor-intensive vessels per phase (Chapter 5). In

addition, evidence for pottery production at sites and techniques of pottery production are discussed (Chapter 6). Two chapters examine published data on differentiation with respect to nonceramic goods at sites as well.

Since sample size is small for each analysis, the conclusions made here should be regarded as hypotheses that can guide future research. In brief, the model is partially supported. A pattern of diversification results in some phases and regions. However, there is no indication of increasing standardization or change in mode of production. Ceramic production in west-central Henan as exemplified by the site of Meishan may have been impacted by a developing bronze industry.

ACKNOWLEDGEMENTS

I am grateful to several individuals for their encouragement and support. First, I thank my committee for guiding me so well as I sought to clarify my ideas on pottery production during the Longshan Period. I am indebted to my advisor Professor Richard Pearson for his valuable advice, enthusiasm, and expertise in employing an anthropological approach in conducting research on Chinese Neolithic data. I was very fortunate that Professor Prudence Rice, University of Florida, kindly consented to be a long distance committee member. Despite her busy schedule, she sent thorough comments on my drafts, to China as well as British Columbia. Her important work on ceramic production provided inspiration for this study. Professor Michael Blake provided a great deal of advice about conducting research on several aspects of complex societies as well as constant encouragement.

This study could not have been completed without the generosity of several scholars in China. I am especially indebted to Professor Yan Wenming of Beijing University for giving me a valuable introduction to Longshan pottery and for writing letters of introduction on my behalf to institutions in Henan and Shandong. I am grateful to archaeologists at the Xiaotun (Anyang) work station, Yang Xizhang in particular, for their permission to examine a number of vessels from Hougang. The members of the Puyang City Cultural Research Bureau generously provided accommodations while I examined vessels from Baiying in the Puyang City

Museum. I thank Sun Dexuan, Zhao Liansheng, Zhang Xiangmei, and Zhao Yan. In Luoyang, Xu Jianyuan gave me permission to see the exhibit of vessels from Meishan and other sites. Other scholars in Henan that kindly gave me information on the Longshan Period include An Jinhuai (Henan Province Cultural Research Institute, Zhengzhou) and at the Archaeological Research Station in Gaocheng (Dengfeng), Wang Zhiguo and Liu Shumin. I thank the following people in Shandong for their help: Du Zaizhong (Weifang City Museum), Zheng Xiaomei and Wang Yongbo at the Shandong Province Archaeological Research Institute, Jinan; Cai Fengshu of Shandong University, and Zhong Huanan. In addition, two other students at Beijing University at the time, Janet Lucas and Chris Feng, gave me much practical advice and encouragement. I thank The Social Sciences and Humanities Research Council of Canada for a Doctoral Fellowship, 1986-1987.

I am grateful to several others for their help. Barbara Mills was in Vancouver conducting research before I left for China. She gave me a great deal of advice about studying ceramic form and function. I thank Greg Schwann, Professor David Pokotylo, and Professor R.G. Matson for statistical advice. Other fellow graduate students at UBC and elsewhere - Sheila Greaves, Heather Pratt, Vicki Feddema, Liz Furniss, and Dana Lepofsky provided humor and support. I am indebted to Joyce Johnson, Susan Matson, and Kitty Bernick for drawing the figures.

Two special friends to thank for their constant support and practical help are Pat and John Berringer. Finally, I am fortunate to have a family that supports me in all my endeavors. I owe special thanks to my parents for all of their help in the last two years.

TABLE OF CONTENTS

ABSTRACT ii

ACKNOWLEDGEMENTS iv

CHAPTER 1. INTRODUCTION: RESEARCH PROBLEM AND ANALYTICAL APPROACH 1

Introduction 1

Analytical Approach 4

Procedures of Analysis 13

CHAPTER 2. THE LONGSHAN PERIOD IN CHINESE PREHISTORY 28

Introduction 28

Regional Diversity During the Longshan Period 28

Approaches to Cultural Complexity During the Longshan Period 34

Archaeological Evidence for Processes of Change 36

Conclusions 51

CHAPTER 3. MODEL OF CHANGE IN SYSTEMS OF CERAMIC PRODUCTION IN RELATION TO INCREASING CULTURAL COMPLEXITY 55

Operating Premises 55

Changes in Strategies of Production 57

Changes in Strategies of Consumers for Prestige Vessels 64

Change in Mode of Production 78

Summary 85

CHAPTER 4. ANALYSIS OF SHAPE CLASSES AND HYPOTHESES ABOUT FUNCTIONAL TYPES 87

Introduction 87

Traditional Terms for Designating Shape Classes 88

Kinds of Ceramic Data in Site Reports 95

Analysis of Shape Classes in Site Reports 101

Hypotheses About Vessel Function 126

Conclusions 135

CHAPTER 5. TEST OF THE MODEL 137

Introduction 137

Analysis of Change in Production: Strategies of Producers 139

Analysis of Change in Labor-Intensive (Prestige) Vessels 168

CHAPTER 6. CHANGE IN MODE OF PRODUCTION AND ACCESS TO GOODS 185

Introduction 185

Evidence for Mode of Production 187

Patterns of Access to Goods 209

Conclusions 220

CHAPTER 7. CONCLUSIONS 223

REFERENCES 239

APPENDIX A. ANALYSIS OF SHAPE CLASSES IN ARCHAEOLOGICAL REPORTS 265

APPENDIX B. DETAILS ON ANALYSES FOR TESTING THE MODEL OF CHANGE IN SYSTEMS OF CERAMIC PRODUCTION IN RELATION TO INCREASING CULTURAL COMPLEXITY 303

APPENDIX C. DATA ON NONCERAMIC POTENTIAL PRESTIGE GOODS, UTILITARIAN ARTIFACTS, AND HOUSING 344

LIST OF FIGURES

figure		page
1.	Types of Longshan Culture in Northern China.	30
2.	Location of Important Sites from the Longshan Period.	31
3.	Model of Change in Systems of Pottery Production in Relation to Increasing Cultural Complexity.	58
4.	Major Forms of Vessels in Longshan Sites.	118
5.	_Guan_ Jar Size Classes, Hougang.	288
6.	Size of _Guan_ Jars, Class Eight, Baiying.	289
7.	_Pingdipen_ Basin Class, Hougang.	290
8.	_Pingdipen_ Basin Size Classes, Hougang.	291
9.	_Pingdipen_ Basin Class One, Baiying.	292
10.	Sizes of _Pingdipen_ Basins, Class One, Baiying.	293
11.	_Wan_ Bowl Class One, Hougang.	294
12.	Sizes of _Wan_ Bowls Class One, Hougang.	295
13.	_Wan_ Bowl Class One, Meishan.	296
14.	Sizes of _Wan_ Bowls, Class One, Meishan.	297
15.	_Wan_ Bowl Classes One and Two, Lujiakou.	298
16.	Sizes of _Wan_ Bowls, Class One, Lujiakou.	299
17.	_Ding_ Tripod Class Seven, Lujiakou.	300
18.	_Bei_ Cup Classes One and Two, Baiying.	301
19.	Sizes of _Gai_ Lids, Classes One to Eleven, Baiying.	302

20. Variation in Dimensions by Period, Large Guan Jars, Hougang. 335

21. Variation in Dimensions by Period, Medium Size Guan Jars, Hougang. 337

22. Variation in Dimension by Period, Medium Size Pingdipen Basins, Hougang. 339

23. Variation in Dimension by Period, Medium Size Wan Bowls, Class One, Hougang. 340

24. Variation in Dimensions by Period, Guan Jars, Meishan. 341

25. Variation in Dimensions by Period, Ding Tripods, Meishan. 342

26. Variation in Dimensions by Period, Ding Tripods, Lujiakou. 343

LIST OF TABLES

table		page
1.	Dating of Phases at Hougang, Baiying, Meishan, and Lujiakou.	14
2.	Samples of Whole and Reconstructed Vessels at Sites.	16
3.	Cultural Features at Sites.	19
4.	Description of Archaeological Sites.	20
5.	Context of Deposition for Vessels in Sample for Analysis.	21
6.	Large, Walled Sites from the Longshan Period.	38
7.	Evidence for Bronze Metallurgy During Longshan Period.	47
8.	Display Behavior with Containers in Chiefdoms and Other Ranked Societies.	69
9.	Display Behavior with Containers: The Chinese Historical Context.	76
10.	Identification of Mode of Production: Ethnographic Data on Ceramic Variability.	83
11.	Published Definitions for Traditional Terms Describing Shapes of Vessels Found in Longshan Sites.	89
12.	Formats of Describing Vessels in Site Reports.	96
13.	Schematic Representation of Levels in Interpreting Samples of Pottery Described in Chinese Neolithic Site Reports.	100
14.	Ratios and Individual Measurements with Formal-Functional Significance Used in Analysis of Shape Classes.	104

15. Summary of Results from Analysis of Shape Classes at Hougang, Baiying, Meishan, and Lujiakou. 110

16. Proposed Definitions for Major Shape Classes of Vessels (Xingzhuang) in Longshan Sites. 113

17. Comparison of Total Number of Shape Classes Made During Each Phase at Hougang, Baiying, Meishan, and Lujiakou. 140

18. Change Over Time in Quantity of Shape Classes by Hypothesized Functional Category at Hougang, Baiying, Meishan, and Lujiakou. 143

19. Quantities of Forms by Hypothesized Functional Category at Hougang, Baiying, and Lujiakou. 147

20. Analysis of Dimensional Standardization. 152

21. Suggested Evidence for Relative Lack of Labor Input in Vessel Forming for Wan Bowls, Class One, Hougang. 158

22. Suggested Evidence for Relative Lack of Labor Input in Decoration and Firing for Ding Tripods, Class Seven, Lujiakou. 158

23. Summary of Change in Strategy of Pottery Production at Hougang, Baiying, Meishan, and Lujiakou. 165

24. Labor-Intensive Vessels That May Have Been Used for Display at Hougang, Baiying, Meishan, and Lujiakou. 170

25. Very Large Vessels at Other Sites From the Longshan Period. 176

26. Labor-Intensive Vessels That May Have Been Used For Display at Other Sites From the Longshan Period, By Cultural Region. 178

27. Hypothesized Archaeological Indicators for Change in Mode of Production. 188

28. Direct Evidence for Pottery Production at Hougang, Baiying, and Meishan by Excavation (T) Area. 195

29. Evidence for Ceramic Production at Other Sites From the Longshan Period. 201

30. Characteristics of Kilns From Other Longshan Period Sites. 206

31. Diversity and Quantity of Nonceramic Potential Prestige Goods at Hougang, Baiying, Meishan, and Lujiakou. 211

32. Diversity and Quantity of Utilitarian Tools at Hougang, Baiying, Meishan, and Lujiakou. 213

33. Variation in Average Size (Floor Area) of Houses By Different Types of Construction Material at Hougang and Baiying. 215

34. Characteristics of Burials with Tall Stemmed "Eggshell" Cups or *Gao Bing Bei* at Chengzi. 217

35. Characteristics of Burials with Tall Stemmed "Eggshell" Cups or *Gao Bing Bei* at Sanlihe. 218

36. Changes Made in Shape Classes of Vessels Identified in the Hougang Report. 266

37. Original Shape Classes Accepted From the Hougang Report. 269

38. Summary of Results from Nonparametric Significance Tests for Hougang Vessels. 271

39. Changes Made in Shape Classes of Vessels Identified in the Baiying Report. 272

40. Original Shape Classes Accepted from the Baiying Report. 275

41. Changes Made in Shape Classes of Vessels Identified in the Meishan Report. 276

42. Original Shape Classes Accepted From the Meishan Report. 277

43. Changes Made in Shape Classes of Vessels Identified in the Lujiakou Report. 279

44. Original Shape Classes Accepted From the Lujiakou Report. 281

45. Lids at Hougang for Covering Other Vessels or For Serving Food. 282

46. Lids at Baiying for Covering Other Vessels or For Serving Food. 284

47. Lids at Meishan for Serving Food. 286

48. Lids at Lujiakou for Covering Other Vessels or For Serving Food. 287

49. Distribution of Vessels in Shape Classes Per Phase at Hougang. 304

50. Distribution of Vessels in Shape Classes Per Phase at Baiying. 307

51. Distribution of Vessels in Shape Classes Per Phase at Meishan. 310

52. Distribution of Vessels in Shape Classes Per Phase at Lujiakou. 312

53. Diversity of Shape Classes and Hypothesized Functional Types Per Period at Hougang. 314

54. Diversity of Shape Classes and Hypothesized Functional Types Per Period at Baiying. 316

55. Diversity of Shape Classes and Hypothesized Functional Types Per Period at Meishan. 318

56. Diversity of Shape Classes and Hypothesized Functional Types Per Period at Lujiakou. 320

57. Variation in Shape of Leg for Xian/Yan Tripods, Hougang. 322

58. Variation in Handles for Xian/Yan Tripods, Hougang. 322

59. Variation in Shape of Leg for Ding Tripods, Hougang. 323

60. Variation in Decorative Techniques for Large Guan Jars, Hougang. 324

61. Variation in Decorative Techniques for Medium-Sized Guan Jars, Hougang. 325

62. Variation in Decorative Techniques for Xian/Yan Tripods, Hougang. 326

63. Variation in Type of Rim for Wan Bowls, Class One, Hougang. 327

64. Variation in Handles for Ding Tripods, Class One, Baiying. 328

65. Variation in Decorative Techniques for Ding Tripods, Class One, Baiying. 329

66. Variation in Shape of Leg for Ding Tripods, Meishan. 330

67. Variation in Decorative Techniques for Guan Jars, Meishan. 331

68. Variation in Decorative Techniques for Dou Stemmed Dishes, Meishan. 331

69. Variation in Decorative Techniques for Ding Tripods, Meishan. 332

70. Variation in Shape of Leg for Ding Tripods, Class Seven, Lujiakou. 333

71. Variation in Handles for Ding Tripods, Class Seven, Lujiakou. 333

72. Variation in Decorative Techniques for Ding Tripods, Class Seven, Lujiakou. 334

73. Variation in Decorative Techniques for Wan Bowls, Class One, Lujiakou. 334

74. Distribution of Potential High Status Artifacts Among Different Types of Sites, with Location of Deposition by Excavation (T) Area. 345

75. Diversity of Utilitarian Tools for Different Types of Sites. 348

76. Variation in Construction Material for Houses (*Fangzi*) at Hougang, Including Identification of Houses with Costly Materials. 349

77. Variation in Construction Material for Houses (*Fangzi*) at Baiying, Including Identification of Houses with Costly Materials. 350

CHAPTER 1. INTRODUCTION: RESEARCH PROBLEM AND ANALYTICAL APPROACH

INTRODUCTION

An important issue in anthropological archaeology is the relationship between change in production of craft goods and increasing cultural complexity. This dissertation examines the relationship between change in production and inferred use of one type of craft item, pottery, and increasing cultural complexity in chiefdoms. It tests a model outlining potential changes in systems of ceramic production with data from Longshan Period sites from the lower and middle reaches of the Huanghe or Yellow River region in northern China. At the end of the Longshan Period, at least one state evolved in this region. Several writers have proposed that specialized pottery production developed during the late Neolithic period (Song, Li and Du 1983:273; Keightley 1987; Feng et al. 1982:22; Li and Cheng 1984:14; An Jinhuai 1989:23).

In the anthropological literature of the last twenty years, researchers have assumed that systems of craft production become increasingly more complex in conjunction with other cultural subsystems. The reasoning is that part-time craft specialization is prevalent in chiefdoms, and full-time specialization in states (Flannery 1972, Wright 1977, 1978).

There are several models that describe how craft specialization in general plays a role in the process of increasing cultural complexity, specifically with respect to the development of political centralization. Most of these models pertain to prestige goods rather than utilitarian or basic goods. They outline how increasing control over production and distribution of prestige items enables elites to increase their political power (Brumfiel and Earle 1987). Models of this kind concerned with rank societies have been proposed by Frankenstein and Rowlands (1978) and Friedman and Rowlands (1977).

Rice (1981) presents a model that outlines how pottery production changes in a context of increasing cultural complexity. Her model shows how changes in pottery production may be regarded as part of the process of increasing segregation, as defined by Flannery (1972). As she points out in a later publication, increasing specialization of pottery production is part of the process by which social systems become increasingly differentiated (Rice 1984:256-7). Her model presents the hypothesis that as cultural systems become more complex, there is an increase in varieties of wares, particularly elite wares. Also, utilitarian wares become increasingly standardized (Rice 1981:222-3,224). The model is supported with data from a Maya site in Belize.

The research question addressed in this study is: "How do systems of pottery production change during the Longshan Period in relation to increasing cultural complexity?" The goal is to present a revised version of the important model outlined by Rice (1981) and to test it with data from another area of the world. The model offered here pertains to a subset of the model by Rice (1981). Ceramic change in complex chiefdoms corresponds to the change from Step 3 in her model, ranked societies, to Step 4, stratified societies (Rice 1981:223). My model is tested with data representing approximately 500 years of ceramic production, rather than 1000 years as in the analysis by Rice (1981).

An attempt is made to describe in more detail how different components of ceramic production systems may change. On the basis of later publications by Rice (1984, 1987), ethnographic data from several areas, and other archaeological studies, the model describes how production of prestige (labor-intensive) and non-prestige (utilitarian) vessels may change as chiefdoms evolve into states. An effort is made to explain how human behavior, i.e., strategies of producers and consumers in chiefdoms, may cause different types of ceramic change. I attempt to investigate production and consumption as processes, by considering the goals and actions of people as causal factors affecting change in material goods (Gosden 1989).

ANALYTICAL APPROACH

In my model the hypothesis is made that systems of ceramic production become more complex in conjunction with other cultural subsystems, as in the model by Rice (1981). Potters, especially specialists in competition with one another, should adopt a strategy of diversification for production of one or more shape classes in response to increasingly varied consumer demands for vessels. There should be an increase over time in varieties of ceramic categories such as decorative and shape classes.

My model, like that by Rice (1981), states that an increase in status competition among consumers should create increased demand for vessels that symbolize prestige. Rice (1981) focuses on identifying change in elite wares. For reasons discussed below, I use the term "prestige vessels", or labor-intensive vessels for use in social displays. My model proposes that two types of displays with labor-intensive pottery should be common in prehistoric chiefdoms; in my terms, largesse and conspicuous consumption. Vessels for preparing, serving, and consuming food and alcohol could be displayed. Responding to consumer demand, potters should produce vessels exhibiting an increase in degree of labor input, or produce a greater number of shape classes with labor-intensive techniques, and/or produce vessels with new labor-intensive techniques.

The model proposes two types of factors that may cause diversification in production of non-prestige wares (not labor-intensive). They are change in diet and change in household rituals (Rice 1984). In response to consumer demand for new types of vessels, potters should produce new shapes and/or decorative techniques. Thus my model describes causal factors affecting utilitarian vessels that do not refer exclusively to specialists controlled by elites as in the model by Rice (1981). Rice (1981:223) outlines how elites may force rural potters to produce surplus wares for tribute and trade purposes.

My model also hypothesizes that potters, especially specialists in competition with one another, should adopt a strategy of simplification, or increased efficiency in production, for one or more shape classes of prestige or non-prestige wares. Again, this hypothesis is made by Rice (1981). One potential causal factor for this change is increasing population size and density. After Rice (1981:223), I expect that there should be evidence for increasing standardization of wares. There may be an increase in dimensional standardization and/or within-class standardization in terms of secondary shape features or decorative techniques.

The model also predicts that there should be a change in organization of labor to produce pottery as sociopolitical complexity increases. There should be a change to a more complex mode of production, such as a household to a workshop mode. This is another type of change that should take place as social systems become increasingly differentiated. The model outlined by Rice (1981) implies that this type of change should take place, since it expects the development of mass production in stratified societies (Rice 1981:223). My model hypothesizes that change in mode of production may be identifiable by change in ceramic attributes (increasing standardization and increasing diversity, after Rice 1981, 1987, 1989), direct evidence for production (such as change from production in houses to workshops), and techniques of production (increasing efficiency in shaping and firing).

The model describes three different strategies of producers in total: diversification, simplification, and conservatism or resistance to change. Thus it provides expectations to test the alternative hypothesis that some or all components of ceramic production systems do not become more complex in conjunction with other cultural subsystems. Like Rice (1984), I expect that ceramic production systems are complex phenomena and that different components may change in different ways.

Given the available data on ceramic variability from the Longshan Period, the model focuses on social factors that can cause ceramic change. It cannot deal with other causal factors described by Rice (1984) that may have been important such as changes in technology (for any step of production such as forming, decorating, firing), changes in sources of raw materials, or changes in exchange systems for raw materials or vessels.

The unit of comparison for testing my model is the shape class. I assess variability in whole and reconstructed vessels from Longshan Period sites. In contrast, the unit of analysis Rice (1981) uses is the ware, defined from sherds by the type-variety system. Technological variation such as type of paste, temper, texture, etc. is an important component of her model. However, very little information on these attributes is available for Longshan Period ceramics.

My model makes a distinction between prestige and non-prestige vessels rather than elite and utilitarian vessels for two reasons; 1) ethnographic data on display vessels used in ranked societies, and 2) practicality for the data set at hand. My survey of the ethnographic literature on pottery-producing societies suggests that elites, or persons occupying the uppermost positions of status such as chiefs, are not the only type of people who may use labor-intensive vessels for displays of status and prestige. For example, displays of conspicuous consumption at life-crisis ceremonies could be undertaken by a range of families.

I expect that this situation characterizes prehistoric chiefdoms as well. Since pottery vessels were widely used, a number of households could acquire labor-intensive vessels, the quantity and degree of elaboration varying with resources of the households. Highly elaborated vessels should have been used by relatively high status people, and less elaborated vessels by households lower on the social scale. Also, pottery vessels may not have been the most important part of the chiefly, versus domestic, economy (Goldman 1970:480-1) in prehistoric chiefdoms. Other more restricted goods in terms of raw materials and skills required for manufacture probably played a more important role.

Rice (1981:223) and others define elite wares on the basis of several attributes such as relatively high labor input and high diversity in terms of decoration, rare raw materials, and restricted spatial distribution on an intra-site as well as inter-site level. Feinman et al. (1981) identify vessels with relatively great labor expenditure, particularly in decoration, by the production step index. A recently developed alternative, the production task index (Hagstrum 1988) evaluates all steps in vessel formation. Analysis of paste composition allows researchers to define non-local wares that were presumably imported by elites (Rice 1977, Costin 1986, Berman 1986). Costin and Earle (1989) compare differences in labor input with context of recovery, examining wares found in elite and non-elite housing.

Unfortunately, there is little relevant published information of this nature for Longshan Period vessels with the exception of labor-intensive techniques for shaping and decorating. Focusing on identifying labor-intensive vessels is worthwhile given their importance in the ethnographic literature on display activities. There are no sufficient independent sources of data available to confidently identify any vessels as used by elites. Very few vessels were found in houses at the four sites examined in this study, as I show below. Also, there is no information on spatial distribution of particular wares within a single settlement system. Therefore, this study emphasizes how prestige vessels could have been used rather than identifying specific types of consumers.

Also, it is not always possible to identify vessels used by elites on the basis of variation in labor input alone. Identification of elite vessels is more reliable if differences in labor input among vessels are extreme. In his survey of craft production in ethnographic societies, Clark (1986:4-5) concludes that objects made for elites by attached specialists exhibit great investment in labor, particularly objects that are elaborated to the point where normal use is not possible due to large size or fragility, etc. However, differences in labor input among vessels may not always be distinct. When there is a low degree of differentiation, identification of elite wares on the basis of ceramic attributes alone cannot be made with confidence.

There is relatively little published information available on ceramic function during the Longshan Period, particularly for individual assemblages. In this study, I infer rather than demonstrate that various shapes of labor-intensive vessels were used for display purposes, on the basis of ethnographic analogy. I hypothesize that labor-intensive vessels were a type of prestige good during the Longshan Period. Information on labor-intensive techniques is limited as well. Unfortunately it was not possible to quantify differences among vessels by means of the production step index (Feinman et al. 1981) or the production task index (Hagstrum 1988).

Archaeological identification of prestige goods in general during the Neolithic and early historic periods has not been the subject of extensive research. Two studies that systematically examine variation in goods (pottery, tools, ornaments) to make inferences about status differentiation during the earlier Neolithic period are Pearson (1981) and Underhill (1983). In my description of the model, I summarize the little information that is published on use of containers (bronze, ceramic) for display purposes during the early historic period. No undisputed bronze vessels have been found from the Longshan Period. This is the first published study of which I am aware that attempts to systematically examine pottery vessels and other artifacts from Longshan Period sites as potential prestige items. However, it has been commonly assumed that one type of ceramic ware, the "eggshell"-thin tall stemmed cups from sites in Shandong, were prestige vessels.

Before describing the analytical procedures undertaken in this study, it is necessary to discuss definitions of terms that are used. Rice (1988, 1989) points out that the term "specialization" has several different connotations. This study is concerned with specialization of producers rather than specialization of production area or resources (see Rice 1989:110). My definition for specialization of producers is derived from Costin (1986:328) and Kaiser (1984:184). I define specialization as a type of organization of human labor in which work units (individuals or groups) regularly produce a limited number of classes of goods rather than the full range of goods available. These work units regularly exchange their products for others that they do not produce themselves. Thus pottery vessels are commodities, or objects produced for exchange (Rice 1987:184). Among non-specialists, production takes place in each household, and consumption takes place at the locus of production (Rice 1987:184).

It is possible to derive test implications for specialization involving ceramic attributes from this definition, such as standardization and diversity, as Rice (1981, 1987, 1989) has shown. My definition does not incorporate other aspects of specialization that are especially difficult to operationalize such as time spent in production (i.e., part- or full-time specialization, see Benco 1988:68) and relative skill of individual potters (see Welch 1986:136-41).

A mode of ceramic production represents a distinct set of social relations between producers, and between producers and consumers. Modes differ in terms of scale of production, or quantities of labor and resources used, as well as quantities of vessels produced (Rice 1987:180-6). Therefore they differ in degree of intensification of production. I use the definition of intensification offered by Rice (1987:190, 1988:6): increased efficiency in production for the purpose of increased yields. In reality, organization of ceramic production is represented by a continuous range of variability (Rice 1987:180-6). Also, more than one mode of ceramic production may be represented in any given society.

The theoretical approach of this study is processualist. Ethnographic examples from several areas illustrating strategies of pottery production and consumption in chiefdoms are used to construct the model. It is likely that there was substantial variation in economic, social, and political organization among ranked societies in prehistory, given the variation noted in the ethnographic record (Feinman and Neitzel 1984, Earle 1987a, Carneiro 1979). However, like Earle and Preucel (1987), I do not accept the symbolic-structuralist or structural-Marxist positions stipulating that no generalizations about processes of cultural change can be made. It is important to determine how changes in craft production during the transition from chiefdom to state in China are similar to, as well as different from, other areas (see Keightley 1987:93 for a different opinion).

This dissertation is the first attempt at systematic analysis of Chinese Neolithic pottery for evidence of changes in production and inferred use. Numerous researchers have made important contributions to other aspects of Chinese Neolithic pottery. Throughout this study I refer to several articles written by Chinese archaeologists on technology. Valuable descriptions of technology have also been published in English by Chinese and western researchers: Wu (1938), Li Chi (1956), Chang et al. (1969), Medley (1976), Li and Cheng (1984), Chang (1986), and Vandiver (1988). Other topics of inquiry in the English literature include identifying ritual sets of pottery in cemeteries (Pearson 1988), making interpretations about mentality

(Keightley 1987), identifying post-marital residence patterns through stylistic analysis (Li Kuang-chou 1981), and tracing the development of regional systems of technology (Huber 1983).

PROCEDURES OF ANALYSIS

The model of change in systems of pottery production in a context of increasing cultural complexity is tested on data derived from two sources: 1) visual observations of whole and reconstructed vessels in archaeological work stations and museums in Henan and Shandong provinces in 1987 during a period of fieldwork six months in duration, and 2) descriptions of vessels in Chinese archaeological reports. In addition, Professor Yan Wenming of Beijing University provided invaluable information and advice about studying Longshan ceramic production.

Eight sites were originally selected for analysis on the basis of the following criteria: relatively detailed site report, presence of more than one phase with adequate dating, and at least some vessels accessible for examination. It is possible to use data from four of these sites in the test of the model; three located in Henan and one in Shandong (Table 1). They are: Hougang (northern Henan), Baiying (northern Henan), Meishan (central Henan), and Lujiakou (north-central Shandong).

Table 1. Dating of Phases at Hougang, Baiying, Meishan, and Lujiakou.

Hougang II Type:

Hougang (near Anyang city, Henan)
3 periods defined on the basis of several radiocarbon dates, stratigraphy, and ceramic seriation: Early (transitional to the Longshan Period), ca. 2700-2500 B.C.; Middle, ca. 2500-2300 B.C.; Late, ca. 2300-2100 B.C. (Anyang Archaeological Team, IA, CASS 1985:82, Zhang and Zhang 1986:52)

Baiying (Tangyin County, Henan)
3 periods defined on the basis of several radiocarbon dates, stratigraphy, and ceramic seriation: Early, ca. 2500-2300 B.C. (my estimate); Middle, ca. 2300-2200 B.C. (my estimate); Late, ca. 2200-2000 B.C. (my estimate); (CPAM of Anyang District, Henan Province 1983:40, Zhang and Zhang 1986:52,54); the Early Period is roughly contemporary with the Middle Period at Hougang, and the Middle Period with the Late at Hougang (personal communication, Zhao Liansheng, 1987)

Wangwan III Type:

Meishan (Linru County, Henan)
2 periods defined on the basis of stratigraphy, ceramic seriation, and two radiocarbon dates: ZK 386, 2290+/160 B.C., ZK 349, 2005+/120 B.C., Early, ca. 2300-2100 B.C. (my estimate); Late, ca. 2100-1900 B.C. (my estimate) (Second Henan Archaeological Team, IA, CASS 1982:472, Zhang and Zhang 1986:53) (the Early Period corresponds to the late Henan Longshan Period, and the Late Period is apparently transitional to the Erlitou I Period, according to the Second Henan Archaeological Team, IA, CASS 1982:472)

Liangcheng Type:

Lujiakou (Weixian County, Shandong)
2 periods defined on the basis of stratigraphy, ceramic seriation, and two radiocarbon dates: ZK 317, 2340+/145 B.C., ZK 321, 2035+/115 B.C., Early, ca. 2350-2150 B.C. (my estimate); Late, ca. 2150-1950 B.C. (my estimate) (Shandong Archaeological Team, IA, CASS and the Art Museum of Weifang County, Shandong Province 1985:348)

At present, data are not available to investigate changes in ceramic production within an individual settlement system. Patterns that result from the analyses should be regarded as characterizing regions, rather than single sites, since the extent to which vessels were exchanged between communities is not known. Some of the shape classes at these sites may have been produced at other locations and imported.

The samples of vessels examined at these sites are described in Table 2. The table indicates some problems that were encountered in analysis. First, reports only describe a subset of vessels recovered from excavation. The quantity of vessels in my sample is not a random sample of the excavated vessels. Second, a relatively low number of whole and reconstructed vessels was directly examined (i.e., outside of glass display cases) from each site. I was not able to examine any vessels from Meishan in this manner.

Third, sample sizes for individual analyses are very small. The site of Hougang provides the best test of the model. I was given permission to directly examine a relatively large number of vessels, and the report describes a relatively high percentage of excavated vessels. For more than one analysis, it is possible to cite published data from other Longshan Period sites to provide support for my interpretations.

The problem of missing information in reports is alleviated somewhat by the fact that reports tend to describe the full range of ceramic variability regarding shape, decorative technique, and type of

Table 2. Samples of Whole and Reconstructed Vessels at Sites. (note: total number of pots in my sample means pots described in reports and/or directly examined)

site	total # pots in site	# pots in my sample	# pots directly examined	location of pots examined
Hougang (Henan)	454	221	125	storeroom, Archaeological Work Station, Xiaotun
Baiying (Henan)	188	114	73	display room, Archaeogical Work Station, Puyang
Meishan (Henan)	no data, probably similar to Lujiakou	103	0, 12 on display	display room, pots in glass cases, Archaeological Work Station, Luoyang
Lujiakou (Shandong)	134	103	60	storeroom, Archaeological Work Station, Hanting

paste. Authors make an effort to describe diversity of techniques present at sites, rather than to describe a large number of vessels of the same type. Emphasis is placed on describing pots with unusual characteristics as well as pots that are relatively well made.

It is not surprising that museum personnel choose vessels for display with these characteristics. The vessels that I examined directly from Baiying and the vessels I saw from Meishan fit this description. I examined a different set of vessels from Lujiakou and Hougang. Apparently, the "nicer looking" vessels recovered from Lujiakou were moved to another city for storage. Since I examined a relatively large number of vessels from Hougang kept in a storage room, the sample that I saw should be an adequate representation of the kinds of vessels recovered in excavation.

The vessels that I examined directly from Hougang, Baiying, and Lujiakou do not constitute random samples of major shape classes (<u>xingzhuang</u>) identified in the reports. In each case, permission to examine vessels was given under the condition that I complete my work within a short time period. Since the samples of vessels from Baiying and Lujiakou available for examination were not large, I examined every vessel present. At the Xiaotun Research Station, I concentrated on examining shape classes with relatively large quantities of vessels. However, I was able to briefly examine every reconstructed vessel from Hougang in the storeroom.

Another problem that affects the analyses is a lack of information in reports on strategies of excavation. It is not possible to ascertain how well samples of vessels represent the total archaeological context. The quality of interpretations one makes about ceramic variability is directly related to the quality of sampling methods used in excavation (Rice 1987:289-90). It appears that a judgmental sampling method was used to select areas for excavation at each site. A number of cultural features, especially houses and storage pits, were found at these sites (Table 3).

It appears that the relatively small number of vessels recovered at Lujiakou and Meishan is largely a factor of the small areas excavated (Table 4). The small number of vessels recovered at Baiying in comparison to Hougang is surprising, given the relatively large area excavated and the quantity of cultural features discovered. One reason for this figure may be that Baiying contained a proportionally large number of vessels broken into small sherds. Therefore, relatively few vessels were available for reconstruction. Or, reconstruction was given a lower priority at the Puyang research station than at the Xiaotun research station.

The majority of vessels from these sites were found in open test areas and storage pits (Table 5). Unfortunately, only a few vessels were recovered from houses, a context of deposition that can provide direct information about consumers. Most likely, emphasis was placed on

Table 3. Cultural Features at Sites.

site	houses	pits	burials	other
Hougang			**	
Early	2	12	1	
Middle	14	35	17	
Late	23	11	11	
(total)	(39)***	(58)	(29)	
Baiying				
Early	9	16	0	K:1, W:1
Middle	8	21	3	(K:2 no
Late	46	50	9	date
(total)	(63)	(87)	(12)	stated)
Meishan				
Early	17	2	12	K:5, W:2
Late	16	42	3	0
(total)	(33)	(44)	(15)	(2,4)
Lujiakou				
Early	6	19		
Late	5	10		
(total)	(11)	(29)		

** burials at sites are jars containing the remains of children; Meishan has a few burials of this type for adults and 3 pit graves for adults with no grave goods

*** one house at Hougang is occupied during two phases

K=kiln, W=well

Table 4. Description of Archaeological Sites.

site	site size	portion dug	Longshan phases	historic phases	date of excavation
Hougang	100,000 m2	1809 m2 (1.81%)	Early (layers 7,6) Middle (layer 5) Late (layers 4,3)	Shang (thin layer)	1931-4, 1979
Baiying	33,600 m2	1830 m2 (5.45%)	Early (layer 6) Middle (layers 5,4,3) Late (layer 2)	Western Zhou (thin layer)	1976-1978
Meishan	not stated	547 m2	Early, Late (layers not clearly stated)	Erlitou Periods I-III, 1 Qing Dynasty and 7 modern burials	1975
Lujiakou	40,000 m2	364 m2 (0.91%)	Early (layers 5,4) Late (layers 3,2)	Western Zhou (a few pits, burials), Shang, Yueshi (a few pits)	1973, 1974

Table 5. Context of Deposition at Sites for Vessels in Sample for Analysis.

context	Hougang	Baiying	Meishan	Lujiakou
house	11 pots (5.0%)	18 pots (15.8%)	3 pots (2.9%)	2 pots (1.9%)
pit	82 (37.1%)	41 (36.0%)	31 (30.1%)	35 (34.0%)
test area	111 (50.2%)	47 (41.2%)	64 (62.1%)	66 (64.1%)
kiln	0	4 (3.5%)	0	0
well	0	1 (0.9%)	0	0
burial	17 (7.7%)	0	2 (1.9%)	0
unknown	0	3 (2.6%)	3 (2.9%)	0
TOTAL NUMBER OF VESSELS	221	114	103	103

recovering and reporting reconstructable vessels from houses rather than sherds.

The first step in testing the model with these data is description of archaeological evidence for chiefdoms and increasing cultural complexity during the Longshan Period (Chapter 2). At present there is relatively little detailed published information on sites. Also, interpreting data on a regional basis has not been a focus of research. The chapter discusses evidence for regional diversity in the Huanghe (Yellow River) valley area and the available information on cultural change in different regions. Hougang and Baiying are located in the Hougang II region, Meishan in the Wangwan III region, and Lujiakou in the Liangcheng region. Hougang was probably a center of settlement, given its large size (Table 4) and evidence of a surrounding wall. At present it is necessary to assume that the Longshan Period is characterized by increasing cultural complexity. It is not possible to demonstrate, for example, an increase in complexity of settlement hierarchies over time on the basis of published data.

The model of change in ceramic production in relation to increasing cultural complexity is presented in Chapter 3. Chapter 4 describes in more detail the kinds of information on ceramic variability included in Neolithic site reports. It also evaluates the shape classes identified in the reports for Hougang, Baiying, Meishan, and Lujiakou, a step essential to testing the model. It assesses the procedures by which authors established shape classes. Variation among vessels in qualitative features and in values of ratios for major dimensions are examined. The chapter also includes a brief evaluation of hypotheses about vessel function during the Longshan Period. Although information on function is extremely limited, it is helpful in making inferences about changes in production of different shape classes.

Chapter 5 presents the test of the model and interpretation of results. Four analyses are undertaken: 1) variety of shape classes in each period, 2) dimensional standardization, 3) within-class standardization, and 4) identification of labor-intensive wares. In the first analysis, I simply count the quantity of shape and size classes at each site, using classes established in Chapter 4. The analysis of dimensional standardization assesses change over time in the range of variation in major dimensions for different shape classes. In the third analysis, I tabulate varieties of vessels in terms of secondary shape features and decorative techniques for individual shape classes. The fourth analysis identifies labor-intensive vessels, including those that are large in size, elaborate in shape, thin-walled, and with a number of decorative techniques.

Two analyses are conducted in Chapter 6. The first assesses whether there is evidence for change in mode of ceramic production during the Longshan Period. It examines ceramic variability, direct evidence for production at sites such as kilns and tools, and the available information on shaping and firing techniques. In the second analysis, comparisons are made on an inter- and intra-site basis about quantity and diversity of potential prestige goods and utilitarian items, both ceramic and nonceramic. Hougang is compared to the other three sites since it probably was a center of a settlement hierarchy. Inferences are made about changes over time in access to goods. There is sufficient information to make inferences about changes in social differentiation on the basis of variation in size and construction material for housing at Hougang and Baiying.

In brief, the model of change in systems of ceramic production in a context of increasing cultural complexity is partially supported. There is a pattern of diversification for the two sites of Baiying (Early to Middle Period) and Lujiakou (Early to Late Period) with respect to variety of shape classes produced. The pattern of change in within-class standardization for Lujiakou is diversification as well. It appears that production of labor-intensive wares diversified over time at Hougang (Middle to Late Period), Baiying (Early to Middle Period), and at Lujiakou (Early to Late Period). There is no evidence for any diversification of production at the westernmost site, Meishan.

The results indicate that systems of ceramic production did not change in a homogeneous manner throughout the Huanghe (Yellow River) valley region. Also, as expected from Rice (1984), there is variation within individual production systems as represented by single sites. For example, although there appears to be a pattern of diversification for labor-intensive wares at Hougang from the Middle to Late Period, the pattern for dimensional standardization is conservatism, and for within-class standardization, simplification. Similarly, two analyses for the Early to Middle Period at Baiying indicate diversification (variety of shape classes and labor-intensive wares), and the analysis of within-class standardization indicates conservatism. There are two patterns for the Middle to Late Period at Baiying, conservatism for variety of shape classes and simplification for within-class standardization. For Hougang, Meishan, and Lujiakou, the pattern that results from the analysis of dimensional standardization is conservatism. It was not possible to conduct this analysis for Baiying. A variety of patterns resulted from the analysis of within-class standardization for each site. There is no evidence for change in mode of ceramic production over time at any site.

The results partially support the hypothesis of Rice (1981) that there should be an increase in varieties of wares produced over time as sociopolitical systems become more complex. I hypothesize that diversification of production at Hougang, Baiying, and Lujiakou is primarily in the realm of prestige wares, a pattern predicted by Rice (1981). However, there is no clear evidence for increasing standardization of non-prestige or utilitarian wares as her model predicts, from the analysis of dimensional standardization or within-class standardization. Also, the prediction about change in mode of production is not supported.

The test should not be regarded as conclusive, since sample sizes are small for each analysis. In the future larger classes of vessels, particularly from Meishan and Lujiakou, should be examined to determine whether there is support for the conclusions made here.

Results for the assessment of change in variety of shape classes are the most secure. Patterns of change regarding within-class standardization are not entirely clear due to small sample size. The analysis of dimensional standardization includes a few shape classes that probably constituted vessels used for basic needs such as cooking and water storage. Sample size did not permit analysis of other functional types of vessels such as labor-intensive wares which could have yielded different results. Information on variation in assemblages with respect to labor-intensive techniques is especially limited. It is only possible to identify some individual vessels that may have been used for social displays. A more thorough assessment of variation in labor input within individual assemblages should be a priority in future research. Finally, at present few reliable test implications are available for identifying change in mode of ceramic production.

Despite these problems, the analytical results provide new hypotheses that can be used to guide future research and new analytical approaches that can be useful in understanding cultural change during the Longshan Period. Also, they demonstrate the importance of testing the hypotheses made by Rice (1981) with ceramic assemblages from different areas. Chapter 7 discusses potential explanations for the differences in results achieved in this study compared to the results described by Rice (1981) for Belize.

One possible explanation is scale of analysis, both temporal and spatial. The analysis by Rice (1981) indicates a fairly homogeneous pattern of long-term changes in systems of ceramic production for a single site. This study examines changes that represent a shorter time span in four assemblages representing a larger region. A variety of patterns resulted. However, considering the Longshan Period as a whole, one could conclude that the model formulated by Rice (1981) and the revised version offered here is supported. Differences in cultural historical processes between the Mayan and Longshan areas may be important as well. I suggest that the development of bronze production during the late Longshan Period had an important impact on ceramic production in central Henan as represented at the Meishan site.

CHAPTER 2. THE LONGSHAN PERIOD IN CHINESE PREHISTORY

INTRODUCTION

This chapter describes archaeological evidence for cultural complexity during the Longshan Period. It is likely that complex chiefdoms were present in a number of areas. Although published data on processes of cultural change are limited, they suggest that chiefdoms began to evolve into states in at least one area. The first section of the chapter describes regional diversity during the Longshan Period. The second section outlines Chinese and western views on cultural evolution during the Longshan Period. The third section describes archaeological evidence for processes of change.

REGIONAL DIVERSITY DURING THE LONGSHAN PERIOD

There is substantial regional diversity represented by archaeological remains from the terminal Neolithic period in northern China. It is more appropriate to refer to a Longshan Period rather than a single Longshan Culture (Yan 1981). Hundreds of sites have been discovered in regions along the lower reaches of the Huanghe or Yellow River including the modern provinces of Shaanxi, Shanxi, Hebei, Henan, and Shandong. The range of dates for these sites is approximately 2500-2000 B.C. (Yan 1981).

On the basis of similarities and differences in remains from this wide area, archaeologists have identified seven "types" (leixing) of Longshan culture (Yan 1981, 1986, 1987a). From west to east, these types are: 1) Kexingzhuang II (southern Shaanxi), 2) Taosi (southern Shanxi), 3) Wangwan III (west-central Henan), 4) Hougang II (northern Henan, southern Hebei), 5) Wangyoufang (eastern Henan), 6) Chengziya (west-central Shandong), and 7) Liangcheng (eastern and south-central Shandong) (Figure 1). 1 The locations of important sites discussed in this study are depicted in Figure 2.

There is debate as to whether additional types should be identified in southern and western Henan (Institute of Archaeology, CASS 1984:78) as well as southern Shandong (Cai Feng, personal communication 1987). Also, there is debate over cultural classification of the Miaodigou II Culture in western Henan, dated to ca. 2780 B.C. Some publications state that Miaodigou II corresponds to the early Longshan Period (Institute of Archaeology, CASS 1983:72, 1984:69). Following Yan (1981; personal communication, 1987b), I regard this culture as transitional to the Longshan Period.

More than one physiographic zone is represented by the seven branches of Longshan culture. Sites from the Kexingzhuang II, Taosi, and Wangwan III types are located at the western part of the North China Central Plain. This area is characterized by loess soil (see Tregear

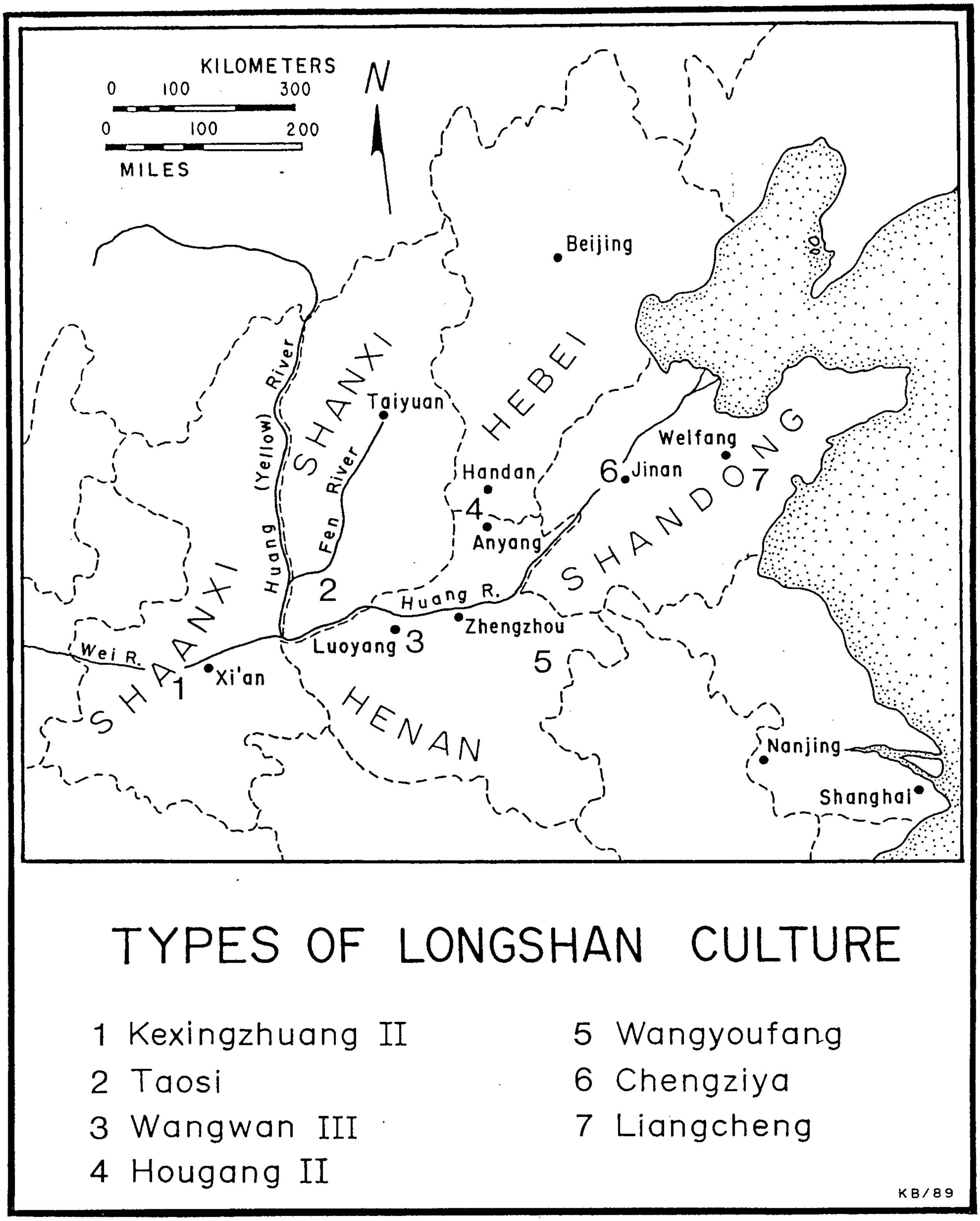


Figure I. Types of Longshan Culture in Northern China.

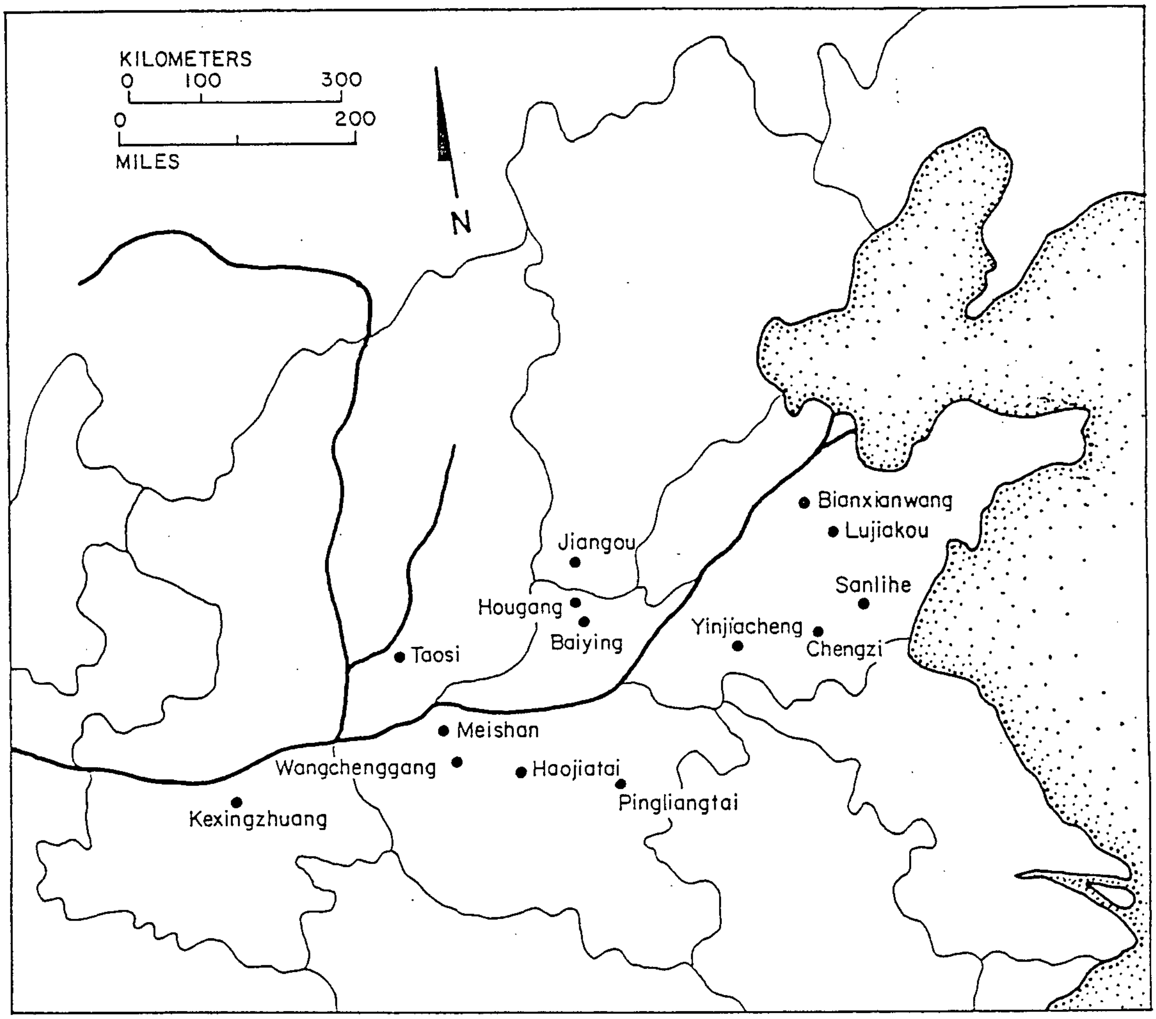


Figure 2. Locations of important sites from the Longshan Period.

1970:32, Map 7). Sites from the Hougang II, Chengziya, Wangyoufang, and Liangcheng types are located in areas with alluvial soil (ibid). Sites from the Hougang II, Chengziya, and Wangyoufang types are situated in the eastern part of the Central Plain. The Liangcheng type incorporates more than one physiographic region: floodplain, the central Shandong mountains, and mesa-like landforms in southern Shandong (see Ren et al. 1985:214). In the central Shandong mountains, elevations exceed 1000m above sea level (ibid). The North China Plain is characterized by a temperate semi-humid climate and deciduous broadleaf forests (Ren et al. 1985:208).

The four westernmost cultural types are particularly important in Chinese prehistory. Communities in these regions were succeeded by state-level societies. The Wangwan III and Taosi types of Longshan culture were succeeded by the first dynasty in China, the Xia. The Hougang II type is ancestral to the Shang dynasty, and the Kexing-zhuang II type is ancestral to the Western Zhou dynasty (Yan 1986, 1987a).

The Shang dynasty began ca. 1700 B.C., and the Western Zhou dynasty, ca. 1100 B.C. (Chang 1986:296-7). No written records from the Xia dynasty have been discovered, but textual data from later periods suggest that the Xia dynasty existed in western Henan and southern Shanxi beginning in ca. 2000 B.C. (Chang 1986:307).

The Xia dynasty is probably represented at least in part by remains from the Erlitou Culture (Chang 1986:316, 1983a). Calibrated radiocarbon dates indicate that Period I of the Erlitou Culture began ca. 1900 B.C. (Institute of Archaeology, CASS 1983:73), a date that roughly matches the period suggested by historical texts. 2

The archaeological remains from Erlitou Culture sites represent the first state-level society in China (personal communication, Yan 1987b, Zou 1987). Another view is that the state level of organizational complexity evolved earlier, during the later Longshan Period in western Henan and southern Shanxi, ca. 2300 B.C. (Zhang and Zhang 1986:55, An Jinhuai 1983a, 1987, 1989). The argument is that the archaeological remains in question could only have been produced by a state-level society. Similarly, Tian (1986) compares archaeological data to legends described in historic texts and maintains that states developed in the Wangwan, Taosi, and Wangyoufang regions during the Longshan Period.

Archaeological data from the Longshan Period are compatible with those from complex chiefdoms (Wright 1984:42-3, Johnson and Earle 1987:211) in other areas of the world. It is likely that complex polities developed in more than one region, not just western Henan and southern Shanxi. After approximately 2000 B.C., states may have eventually developed in the Kexingzhuang II (proto-Zhou) and Hougang II (proto-Shang) regions that began to compete for power with the Xia state (see Chang 1983a, 1986:361).

APPROACHES TO CULTURAL CHANGE DURING THE LONGSHAN PERIOD

In China as in western countries, there is debate over suitable theoretical approaches for investigating development of cultural complexity. Some scholars such as An Jinhuai (1989) employ Marxist theory to explain how and why culture changed over time during the Longshan Period. They describe how primitive societies organized as patrilineal clans evolved into states and civilizations with the institution of slavery. Other scholars such as Tong (1989) consider how theories developed in the West compare to ideas advanced by Chinese writers and how they may illuminate processes of change in Neolithic societies. Yan (1986, 1987a) describes archaeological evidence for potential causal factors in state formation such as warfare and social stratification.

Archaeologists in the West have been concerned with comparing cultural evolution in northern China to other areas. Chang (1986:243-4,286-7; 1983a) considers evidence for processes of change that have been considered important in the western archaeological literature such as development of increasingly wide spheres of interaction. In another work, Chang (1983b) uses textual data to describe specific features that characterize the early dynastic periods in China and argues that these features developed from late Neolithic cultures. He maintains that certain kin groups amassed political power primarily by controlling access to production and use of wealth items with ritual significance:

bronze vessels and other craft items with animal designs, etc., that were necessary for communicating with the gods and ancestors.

Some generalizations about state formation in northern China have been made on the basis of a limited review of the English-language archaeological literature. Haas (1982, 1986) examines data from the Shang period and in contrast to Chang (1983b), argues that accumulation of economic and physical power was more important in state formation than ideological power. He compares processes of change in China with Mesoamerica. Employing a structural-Marxist approach to explaining cultural evolution in northern China, Friedman and Rowlands (1977), and more recently, Maisels (1987) describe how the "Asiatic state" (said to be represented by the Shang and Zhou dynasties) developed from tribal systems. They also argue that lineage organization and development of increasingly wide spheres of interaction played a key role in cultural change. Maisels (1987) compares state formation in northern China to that in Mesopotamia.

It is not possible at the present time to make broad conclusions about processes of state formation in northern China. Relatively little research on state formation has been conducted (An Zhimin 1988a:759, Chang 1983b:129). Also, it is presently impossible to describe cultural change over time in a detailed manner on the basis of published archaeological data. It is particularly difficult to reach conclusions on cultural change for separate regions. Archaeological research in

China has focused on the site rather than the region as the cultural unit of analysis.

At this stage, archaeological data from the Longshan Period should be examined on a relatively fine scale. It is necessary to document accurately culture change at a site and regional level. This procedure requires careful examination of chronological data. Generalizations about processes of change should be demonstrable by archaeological remains.

In the following section, I outline the limited evidence at hand for processes that have been regarded as important in the evolution of cultural complexity in other areas of the world: changes in settlement pattern, warfare, and social stratification in terms of differential access to goods. I attempt to draw conclusions about cultural change in northern China on a site and regional basis (see also Pearson and Underhill 1987; Underhill in press a,b).

ARCHAEOLOGICAL EVIDENCE FOR PROCESSES OF CHANGE

Settlement Hierarchies

Detailed data on settlement patterns for individual regions have not been published; however, it is possible to describe evidence for the presence of settlement hierarchies on the basis of site size and presence of significant architectural features. Relatively large sites with surrounding walls made of rammed earth (hangtu) have been found in four of the seven Longshan cultural regions: Wangwan III (the Haojiatai and Wangchenggang sites), Hougang II (Hougang), Wangyoufang (Pingliangtai), and Liangcheng (Bianxianwang) (Table 6). 3

As survey, excavation, and publication proceed, the political, social, economic, and ritual functions of these sites will become clearer. At present, four of the five sites do not have complete excavation reports (Hougang is the exception). Two of the sites were only recently discovered, Haojiatai and Bianxianwang.

Three sites are similar in size with respect to total surface area: Pingliangtai, Haojiatai, and Bianxianwang. Hougang and Wangchenggang represent opposite ends of the spectrum, at 10 and 1 hectares, respectively. However, it may be necessary to revise these figures after more excavation and publication are completed. For example, in a recent article Sui (1988:47) maintains that Bianxianwang is 100,000 m2 or 10 hectares in size.

These large, walled sites were probably either primary or secondary centers. Large sites with architectural features that require relatively great amounts of labor input tend to be centers in settlement hierarchies (Earle 1987a; Carneiro 1979, Peebles and Kus 1977, Steponaitis 1981). One well-known example of a walled settlement from a chiefdom is the Moundville site (Peebles and Kus 1977:444). Also, sites from the Deh Luran Plain in Iran of a similar size range to those in northern China are identified as centers. Wright (1984:63) maintains

Table 6. Large, Walled Sites from the Longshan Period.

Wangwan III Type:

Wangchenggang (Dengfeng County, Henan)
surface area ca. 10,000 m2 (1 hectare) wall built during period II, 2455+/145 B.C., ZK 581 (Henan Province Cultural Research Institute and the Archaeological Section of the Museum of Chinese History 1983:8,11-13,16; Zhang and Zhang 1986:53) (5 periods defined at site on the basis of three radiocarbon dates, stratigraphy, and ceramic seriation; ca. 2500-1900 B.C.)

Haojiatai (Yancheng County, Henan)
surface area ca. 60,000 m2 (6 hectares), wall built ca. 2500 B.C. (Renmin Ribao 1986)

Hougang II Type:

Hougang (near Anyang city, Henan)
surface area ca. 100,000 m2 (10 hectares), wall built at end of Middle period according to Sui (1988:47), date for pit H2 is ZK 133, 2340+/140 B.C. (Zhang and Zhang 1986:52, Anyang Archaeological Team, IA, CASS 1985:33,82) (3 periods defined at site on basis of several radiocarbon dates, stratigraphy, ceramic seriation; occupation ca. 2700-2100 B.C.)

Wangyoufang Type:

Pingliangtai (Huaiyang County, Henan)
surface area ca. 50,000 m2 (5 hectares) wall built before period III, probably during period II, date for period III is WB 81-2, 2405+/175 B.C. (Henan Province Cultural Research Institute and the Cultural Objects Division of the Zhoukou District 1983:21,36; Zhang and Zhang 1986:53) (5 periods defined at site from two radiocarbon dates, stratigraphy, ceramic seriation; occupation ca. 2500-2000 B.C.)

Liangcheng Type:

Bianxianwang (Shouguang County, Shandong)
surface area ca. 44,000 m2 (4.4 hectares) wall built ca. 2050 B.C. (Renmin Ribao 1985)

that settlements ca. 10 hectares in size are major centers and that sites approximately 3 hectares in size are subsidiary centers.

At least some high status individuals probably occupied the large walled communities, whether status is defined on the basis of power, wealth, occupation, or other attributes. This expectation is particularly relevant to northern China, because textual data suggest that high ranking kin groups lived in walled communities during the early dynastic period (Chang 1986, 1983a). Also, there is other archaeological evidence for the presence of high status individuals in these settlements such as differentiation in housing and consumption of prestige goods, as described shortly.

The three walled sites from the Wangwan III (west-central Henan) and Wangyoufang (eastern Henan) types of Longshan culture were built at approximately the same time, i.e., during the early Longshan Period, ca. 2500 B.C. 4 The wall at Wangchenggang was built during period II (Henan Province Cultural Research Institute and the Archaeological Section of the Museum of Chinese History 1983:8,11,12), ca. 2455 B.C. (ZK 581, Zhang and Zhang 1986:53). The Haojiatai site dates to ca. 2500 B.C. (Renmin Ribao 1986). The wall at Pingliangtai was built sometime before period III, or before ca. 2405 B.C. (Zhang and Zhang 1986:53, Henan Province Cultural Research Institute and the Cultural Objects Division of the Zhoukou District 1983:21,36).

The wall at Hougang was built slightly later in time, approximately 2300 B.C., according to Sui (1988:47). The easternmost walled site was established considerably later in time than the sites in Henan, ca. 2050 B.C. (Renmin Ribao 1985). Competition between social groups must have intensified at an earlier period in Henan than in Shandong. Furthermore, competition intensified first in the Wangwan III and Wangyoufang regions, necessitating establishment of nucleated, defendable communities.

Warfare

Defense was probably one reason that the walled settlements were built. There are several lines of archaeological evidence for warfare during the Longshan Period: structural features at settlements in addition to walls, skeletal remains indicative of violent death, and weapons. At present there is no information on causal factors or the type of fighting taking place. Warfare must have been an important process in state formation in northern China (Yan 1986). Increasing differentiation in wealth may have caused an increase in the frequency of warfare to acquire booty (ibid). Warfare may have erupted over competition for land after the death of a chief, a situation that occurred during the prehistoric period in Hawaii (Johnson and Earle 1987:232). Of course, internal rather than inter-group conflict may have been a factor as well.

The site of Pingliangtai has a number of additional structures that were probably built for defensive purposes: two small buildings that appear to be guardhouses, two gates, and a wide ditch (Henan Province Cultural Research Institute and the Cultural Objects Division of the Zhoukou District 1983, Chang 1986:265). According to Tian (1986), the ditch is 30 meters wide and was used as a moat. The newspaper report for Haojiatai mentions the presence of a ditch, too (Renmin Ribao 1986). Another function of the surrounding walls may have been to protect habitation areas from floodwater (Du, personal communication 1987).

The site with the most convincing evidence for skeletal remains indicating violent death is Jiangou (Handan County, southern Hebei) in the Hougang II region. The remains at Jiangou indicate a degree of violence not present during the pre-Longshan period (Underhill 1989). First, several skeletons representing both sexes and a range of ages were found in a well. Some individuals were decapitated, and a few people may have been buried alive (Chang 1986:270).

Second, there are six skeletons from Jiangou that have marks from hacking or scalping with a stone tool (Yan 1982a:38-9). Two are female youths, two are male adults, and two are unidentifiable. Only the two skulls identified as female show traces of scalping. Yan (1982a:39) suggests that the skulls of the dead were cut open and used by the victors as drinking cups. He states that the skeletal remains from Jiangou date to ca. 2300 B.C. (Yan 1982a:39). It may not be coincidental that this is the estimated time period for the building of the wall at Hougang, as discussed in the previous section.

Several sites, from more than one region and time period, contain incomplete skeletons in pits. The significance of these skeletons is unclear. Hao (1983:42) believes that these skeletons represent war captives who may have been put to death, or, persons who died from fighting. Skeletons of this kind were found at the Wangwan site (near Luoyang city, western Henan) in the Wangwan III region and at the Kexingzhuang site (near Xian city, eastern Shaanxi) in the Kexingzhuang II region (Hao 1983:6, 39-40). Fang (1986:274) also argues that skeletons of this kind from the Wangchenggang site represent war captives who were sacrificial victims. Both authors do not state that the skeletal remains are associated with a specific time period.

Archaeological reports identify a number of stone and bone tool forms as weapons such as mao spearhead. Unfortunately, it is not possible to determine whether these forms were used as weapons or for subsistence tasks such as hunting. Axes (fu) and knives (dao) could have been used for many tasks.

Yan (1986, 1987a) maintains that projectile points (zu) increase dramatically in number over time and that spearheads appear at the beginning of the Longshan Period. Also, improvements in design make projectile points more lethal.

In another paper, I attempted to tabulate the number of stone and bone potential weapons at five Longshan sites (Underhill 1989:234-5). It was possible to examine trends over time at Baiying in the Hougang II region and Meishan in the Wangwan III region. At both sites, there is an increase over time in quantity of projectile points, a possible indication of an increase in the frequency and/or intensity of warfare during the Longshan Period. Also, Chang (1986:250) points out that spearheads and projectile points constitute a relatively high proportion of stone tools at two sites from the Liangcheng region in Shandong, Chengzi (Zhucheng County) and Yaoguanzhuang (near Weifang City).

Differentiation in Consumption of Goods

A common feature of ranked societies is display of social status with a range of material goods. Wealthy families may live in large houses built with relatively costly construction materials (Blake 1988, Kamp 1987, Feinman and Neitzel 1984). Wealthy households tend to be large in size because they have adequate resources for supporting a large number of people (McC. Netting 1982, Hayden and Cannon 1984). Also, they often display their positions of status by using goods that are costly to acquire (Kamp 1987, Smith 1987). There is evidence for differentiation in consumption of goods throughout the Longshan Period. Walled sites contain large houses built with relatively costly materials. There is marked variation in mortuary treatment at some cemeteries. Bronze, jade, and turquoise items were probably prestige goods.

Variation in size and construction material for housing at two walled sites, Pingliangtai and Wangchenggang, is marked. At least 12 large adobe houses have been found at Pingliangtai. Adobe is known as a relatively costly construction material in other areas (Blake 1988:51). One of these houses, F1 from Period IV, is reported as 12.54 by 4.34 meters (Henan Province Cultural Research Institute and the Cultural Objects Division of the Zhoukou District 1983:30). There are houses in this size range from periods II and III as well (Sui 1988:51). At Wangchenggang, variation in housing is apparently most distinct during Period II (ca. 2500 B.C.), the period in which the wall was built. Large hangtu or rammed-earth house foundations were found (Li Xiandeng 1983:11). Rammed-earth is a costly construction material for buildings used by elites during the Shang Dynasty (Chang 1986:323).

Another unique feature of the walled settlement at Pingliangtai is the presence of pottery pipes for drainage of water (Henan Province Cultural Research Institute and the Cultural Objects Division of the Zhoukou District 1983). Wells are another architectural feature which require substantial labor to construct. However, they are common on sites with and without walls (see Institute of Archaeology, CASS, 1984:83-4).

There is marked differentiation in mortuary treatment at sites in Shanxi and Shandong in type of grave, and quality and quantity of interred goods. The Taosi site (Xiangfen County, Shanxi) is unique in terms of the large quantity of graves and wealth of objects recovered.

More than 1000 graves have been discovered to date. Three distinct sizes of graves have been identified: large, medium, and small (for descriptions in English see Chang 1986:276 and Underhill, in press, a). All of the nine large graves contain adult males with large quantities of finely made items, including a pottery pan dish with a painted dragon design, an alligator skin drum, qing chime stones, and jades. One of the large burials, M3015, contains as many as 178 items (Shanxi Archaeological Team, IA, CASS and the Linfen District Cultural Bureau 1983).

As research and publication proceed, it will be possible to clarify how mortuary treatment changes during the 600 years that the cemetery at Taosi was used. Three periods have been defined on the basis of stratigraphy, ceramic seriation, and several radiocarbon dates: Early, ca. 2500-2300 B.C.; Middle, ca. 2300-2100 B.C.; and Late, ca. 2100-1900 B.C. (Zhang and Zhang 1986:51, Gao et al. 1984:28). At least some of the large burials are dated to the Early and Middle Periods (Shanxi Archaeological Team, IA, CASS and the Linfen District Cultural Bureau 1983:32-4). The large grave with the painted pan dish dates to the Early Period (ibid).

One cemetery in Shandong also exhibits differentiation in mortuary treatment, but to a lesser degree than Taosi. At Yinjiacheng (Sishui County), a large grave also contains the remains of an alligator drum (Institute of Archaeology, CASS 1984:20). There are two radiocarbon dates for Yinjiacheng, ca. 2550-2400 B.C. (Han 1989:144).

Information on production and use of non-ceramic prestige goods such as bronze items during the Longshan Period is limited. Fragments of bronze have been found at only a few sites, at both walled sites and sites without walls (Table 7). Four cultural regions are represented: Wangwan III, Wangyoufang, Taosi, and Liangcheng. Chang (1983a:101) expects that political power during the early dynastic period was achieved by controlling production and use of bronze items, especially vessels. However, there is no undisputed evidence for production of bronze vessels during the Longshan Period. Also, there is no indication that elites successfully controlled production of bronze vessels or tools at this time. Elite control may not have been achieved until after the state form of sociopolitical organization had been established. Most of the evidence dates to the late Longshan Period.

The earliest remains are from Pingliangtai, traces of bronze dated to ca. 2400 B.C. (Henan Province Cultural Research Institute and the Cultural Objects Division of the Zhoukou District 1983:31,36; Zhang and Zhang 1986:53). According to An Jinhuai (1983b:5), the remains show signs of smelting and casting.

The significance of the metal fragment from Period IV at Wang-chenggang is unclear. Some claim that the fragment is from a cast vessel (Li Xiandeng 1983:10, An Jinhuai 1989:23). Others argue it is merely a piece of copper (Zou, personal communication 1987). Two sites without walls from the Wangwan III region contain fragments of metal dating to the late Longshan Period, Meishan (Second Henan Archaeological

Table 7. Evidence for Bronze Metallurgy During the Longshan Period.

Wangwan III Type:

Wangchenggang
bronze fragment in pit H617 (6.5 cm wide and 5.7 cm long), possibly from a vessel; composed of lead, tin, copper (concentrations not stated) pit H617 dated to period IV, ZK 955, 1900+/165 B.C. (Henan Province Cultural Research Institute and the Archaeological Section of the Museum of Chinese History 1983:13, Zhang and Zhang 1986:53)

Meishan
traces of bronze on two ceramic crucible fragments from the Late period, in pits H40 and H28; composition of metal in H40 is 95% copper; Late period date ZK 349, 2005+/120 B.C. (Second Henan Archaeological Team, IA, CASS 1982:453-4, 472; Zhang and Zhang 1986:53)

Niuzhai
fragments of bronze, no date available (Yan 1984:38)

Wangyoufang Type:

Pingliangtai
fragment of bronze 1.31 cm long in pit H15, dated to period III, WB81-2, 2405+/175 B.C. (Zhang and Zhang 1986:53, Henan Province Cultural Research Institute and the Cultural Objects Division of the Zhoukou District 1983:31,36)

Taosi Type:

Taosi
small cast bronze bell (97% copper, traces of lead and zinc) in burial M3296, ZK 1314 is 1885+/130 B.C., but the excavators believe a more accurate date is ca. 2085 B.C.; also a small bronze bell found on the surface (Shanxi Archaeological Team, IA, CASS and the Linfen District Cultural Bureau 1984:1070); 2085 B.C. belongs to the either the Middle or Late period (Gao et al. 1984:28, Zhang and Zhang 1986:53)

Liangcheng Type:

Sanlihe
two pieces of an awl made of brass in a burial, according to Sun and Han 1985:275)

Team, IA, CASS 1982:453-4) and Niuzhai near Zhengzhou city (Yan 1984:38).

Fragments of metal have been found from more than one site from the Liangcheng region in Shandong (Yan 1984:38, Sun and Han 1985). The two pieces of an awl from Sanlihe (Jiaoxian County) have been described in the most detail. According to Sun and Han (1988:275), it is made of brass rather than bronze.

One small bronze bell-shaped object was found in grave M3296 at Taosi, dating to ca. 2085 B.C. (Shanxi Archaeological Team, IA, CASS and the Linfen District Cultural Bureau 1984:1069-1070). It is important to note that this burial is relatively small and contains few grave goods. Bronze objects may not have been considered as highly important prestige items until the early dynastic period.

Jade and turquoise were considered prestigious raw materials during the early dynastic period (Chang 1986:312, 331). Jade and turquoise objects from the Longshan Period have been found at walled and non-walled habitation sites. Jade items have been reported at the walled site of Haojiatai (Renmin Ribao 1986), and turquoise ornaments at Wangchenggang, Period II (Henan Province Cultural Research Institute and the Archaeological Section of the Museum of Chinese History 1983:11). Unfortunately, dates are not available for the long, thin jade axes with engraved designs recovered over fifty years ago at the site of Liangchengzhen, Rizhao County, Shandong, type site of the Liangcheng cultural branch (see Institute of Archaeology, CASS 1984:103, Li and Gao 1979).

A much greater quantity and variety of jade items have been recovered from mortuary contexts in Shanxi, Shaanxi, and Shandong. There are several forms of jades in the graves at Taosi from more than one period including ornaments such as bracelets (bihuan) and yue axes (Shanxi Archaeological Team, IA, CASS and the Linfen District Cultural Bureau 1983). A recent article reports a remarkable quantity and variety of jade objects from the Shimao cemetery site in northern Shanxi (Shenmu County), a site that belongs to a cultural branch related to Kexingzhuang II (Dai 1988). Jade and turquoise items were found in a few graves from more than one period at the Sanlihe cemetery site in the Liangcheng region of Shandong (Institute of Archaeology, CASS 1988). Although the dimensions of social status expressed in mortuary ritual are unclear, burying prestige items with the dead would have been an effective method of displaying rank and wealth.

Chang (1983b, 1986) proposes that a number of artifacts from the Longshan Period have ritual significance, including jade and ceramic objects with certain designs, ceramic phalli, and divination bones. He (1983b:101) argues that elites obtained political power during the early dynastic period by controlling access to a variety of artifacts used for rituals in communicating with the gods and ancestors, in addition to bronze vessels. He implies that this process began during the Longshan Period (Chang 1986:287, 366).

Claim to direct communication with the gods is a common method of legitimizing power and authority in chiefdoms (Peebles and Kus 1977, Wright 1984). However, the evidence for this process during the Longshan Period is limited. Also, some types of ritual items such as ceramic phalli and divination bones (bu) probably were used by all segments of society, not just high status individuals competing for power. Common at late Neolithic sites, they were probably used for ancestor worship (Chang 1983b, 1986).

Two types of designs on jade and ceramic objects from late Neolithic sites may have had ritual significance: animal motifs and the thundercloud (leiwen) pattern. Artifacts with animal designs have been found in the Taosi and Liangcheng cultural regions. The Taosi site provides some support for Chang's hypothesis: the ceramic vessel with painted dragon design was found in a large grave with abundant grave goods. One of the large jade axes from the Liangchengzhen site in Shandong has an engraved design of the mythical taotie animal. Axes with this design may have been used in rituals by elites, because the design is present on bronze vessels from the early dynastic period (Li and Gao 1979:61-2).

Sherds of black ware with the thundercloud (leiwen) pattern have been found at two sites in Shandong, Liangchengzhen and Shangzhuang in the Chengziya cultural region (Chiping County). This design is present on Shang and Zhou bronze vessels, too (Institute of Archaeology, CASS 1984:103). Unfortunately, there is no information on context of recovery at either site. The sherd at Shangzhuang was found on the surface (Institute of Archaeology, Shandong Province 1985:494).

Other artifacts may have been used by high status individuals for ritual purposes. Tian (1986) maintains that a wooden "storehouse-shaped" vessel from a large grave at Taosi is a symbol of the sky and was used by rulers to make sacrifices to heaven (see Shanxi Archaeological Team, IA, CASS and the Linfen District Cultural Bureau 1983:38). Chang (1986:276-7) suggests that the musical instruments from large graves at Taosi (qing chime stone, alligator skin drum, etc.) symbolize special status of the deceased, since historic texts mention that items of this sort were used by royalty.

CONCLUSIONS

Sites from the Longshan Period are located in a wide area along the lower reaches of the Huanghe or Yellow River. Seven distinct cultural types have been identified, each of which probably contained complex chiefdoms. There is evidence for similar processes of change in each region: establishment of settlement hierarchies, warfare, and display of social differentiation with prestige goods. Cultural complexity probably increased over time in more than one region. At the end of the Longshan Period, the state evolved in at least one region, Wangwan III in west-central Henan and southern Shanxi.

As research and publication continue, it will be possible to test hypotheses about cultural change in a more detailed manner. One pattern that emerges from this assessment is that settlement hierarchies with walled sites as centers were established in the early Longshan Period, ca. 2500 B.C. in the Wangwan III (west-central) and Wangyoufang (eastern) cultural areas of Henan. Settlement hierarchies were probably established at a later time in the other areas, particularly in Shandong.

There is evidence for warfare and display of social differentiation at walled sites and at sites without walls throughout the Longshan Period. Variation in housing and prestige goods is relatively marked at two walled sites, Wangchenggang and Pingliangtai. This pattern was established during the early periods at the sites. Similarly, status differentiation is expressed in mortuary ritual during the early period at Taosi.

Several forms of artifacts may have had ritual significance. More data are required to test the hypothesis raised by Chang (1983b, 1986) that high status individuals began to seize power by controlling production and use of ritual artifacts. Similarly, more data are necessary to examine the relative importance of competition for economic, social, and ideological power by elites, the issue raised by Haas (1982, 1986).

There is little evidence to suggest that material factors such as technological change were as important in cultural change as social factors (Chang 1983b:124), although some changes in agricultural production may have taken place. The relatively large surface area and thickness of cultural layers at late Neolithic sites suggest that improvements in agricultural production had been made (Yan 1989), allowing population density to increase. For example, there may have been improvements in tool forms (An Jinhuai 1989:22).

At present there is little information on foods produced during the Longshan Period. Foxtail millet (su), broomcorn millet (shu), and rice (dao) (Oryza sativa) were common crops in the late Neolithic period (An Zhimin 1988b, Yan 1989, 1982b). 5 There may have been an increase in species of domesticated animals by the Longshan Period: goat, sheep, cattle, chicken, pig, dog, and possibly the horse (An Zhimin 1988b:377).

notes:

1) For descriptions of distinguishing features (mainly ceramic) for cultural types in the western provinces, see Zhang and Zhang (1986); for the cultural types in Shandong, see Han (1989) and Wu and Du (1984).

2) According to Pankenier (1985), astronomical records support the conclusion that the Xia Dynasty began ca. 1900 B.C. In approximately 1953 B.C., there was a rare clustering of five planets, an event that may have influenced development of the Mandate of Heaven concept.

3) The well-known walled site of Chengziyai in Shandong has been included by Chang (1986) and Sui (1988) with the group of sites listed above. Others have argued that Chengziyai probably dates to the post-Longshan Period Yueshi Culture (personal communication, Yan 1987b, Zou 1987). For this reason, I do not discuss the site further. Also,

Chang (1986:250) states that remains of a wall were found around the site of Yaoguanzhuang in eastern Shandong. However, there is no mention of a wall in the site report (see Institute of Archaeology, Shandong Province et. al 1981).

4) Radiocarbon dates cited in this thesis are based on a half-life of 5570 and calibrated by means of dendro-chronology, as described by Institute of Archaeology, CASS (1983:1-6). Some sources cite the specific calibration curve used (i.e., Institute of Archaeology, CASS 1983), but most do not (such as Zhang and Zhang 1986).

5) Foxtail millet and broomcorn millet have been found in earlier Neolithic sites from the Huanghe (Yellow River) valley area (An Zhimin 1988b:372-5). It is likely that farmers continued to grow these crops in most regions during the Longshan Period. Yan (1989) states that foxtail millet was the most common variety of millet during the late Neolithic period in the lower Huanghe region. It has been recovered at two Longshan sites in eastern Shandong and at one site in Shaanxi. The site in Shaanxi has also yielded broomcorn millet. Rice has been found at one Longshan site in eastern Shandong (An Zhimin 1988b:375) as well as one site in Shaanxi (Yan 1989). According to Yan (1982b:29, Figure 12), rice probably became a common crop in the lower Huanghe valley during the third millennium B.C.

CHAPTER 3. MODEL OF CHANGE IN SYSTEMS OF CERAMIC PRODUCTION IN RELATION TO INCREASING CULTURAL COMPLEXITY

This chapter has four parts. The first three sections consist of: 1) discussion of operating premises, 2) description of changes in strategies of production and test implications for ceramic variability resulting from standardization and diversity, and 3) description of changes in strategies of consumers for prestige (labor-intensive) wares with test implications for differentiation in labor input. The fourth section is a discussion of test implications for identifying change in mode of production and consideration of expectations by researchers for specialization of production during the Longshan Period.

OPERATING PREMISES

As stated in Chapter 1, the research question is: How do systems of pottery production change during the Longshan Period of northern China in relation to increasing cultural complexity? The goal is to test a revised version of the model by Rice (1981) which hypothesizes that there should be an increase in varieties of wares, particularly prestige vessels used for displays of status. Also, there should be evidence for increasing standardization of wares, especially utilitarian (non-prestige) vessels. The model also hypothesizes that there should be a change to a more complex mode of production.

In this study I assume that changes in decisions about strategies of production by potters and strategies of vessel use by consumers may cause changes in ceramic attributes. Production and consumption are related in a circular manner (Douglas and Isherwood 1979:145, Gregory 1982:13). In a chiefdom, potters may initiate changes in production of vessels that, in turn, cause changes in strategies of consumers. At the same time, changes in consumer demand for certain classes of vessels may cause changes in strategies of production. Causal factors for change or stability in systems of production may be external or internal (Rice 1984). In my model one causal factor internal to social systems is considered as particularly influential: competition, both among producers and among consumers. Another study dealing with competition between potters, but in state-level societies, is described by Feinman et al. (1984). They describe how competition is affected by degree of administrative control over economy and degree of regional political consolidation.

Any model is a simplification of reality. Ceramic change is often caused by a complex set of interacting variables, and after a time lag (Rice 1987:274,276). Another limiting factor is archaeological recognition of important causal variables. It can only be hoped that, as research on the Longshan Period proceeds, more detailed models of causes of ceramic change will be constructed and tested.

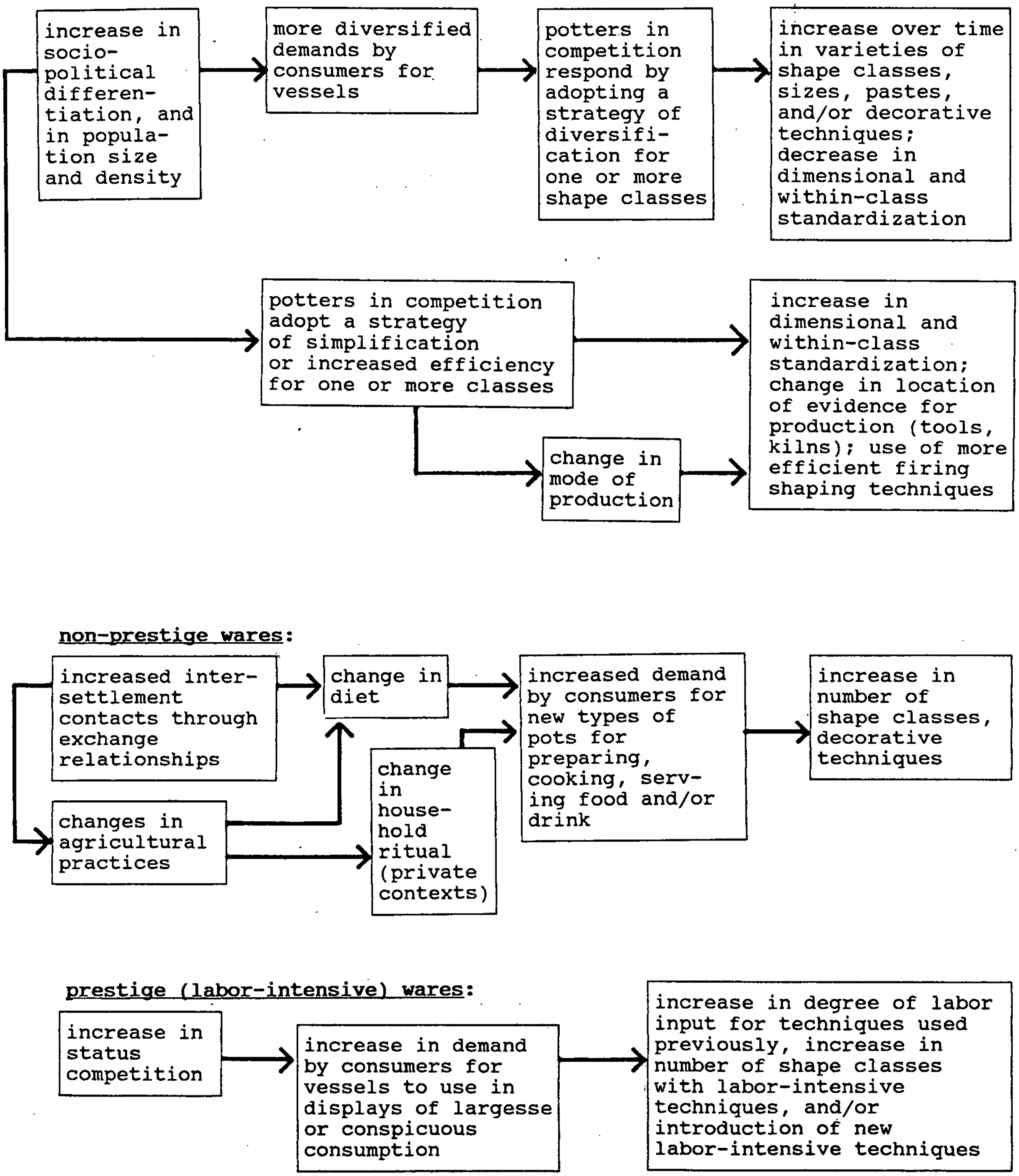
CHANGES IN STRATEGIES OF PRODUCTION

As Chapter 1 mentions, two general strategies of production are diversification, or efforts to produce more varieties of vessels, and simplification, or efforts to reduce variety for purposes of increasing efficiency. Potters may choose to vary production of paste, form, and/or decorative classes. A third strategy is conservatism, or resistance to change in production. A given assemblage of vessels from a community may exhibit evidence for one or more of these strategies.

As depicted in Figure 3, the model employed here hypothesizes that potters should adopt a strategy of diversification for the production of one or more shape classes as sociopolitical complexity increases. The top half of the figure outlines the model in general. The lower half describes specific changes that may take place with respect to utilitarian (non-prestige) and prestige (labor-intensive) wares.

Potters may respond to increasingly diversified demands by consumers for non-prestige vessels used in preparing, cooking, and serving food or drink, and for household rituals that take place in private contexts. At the same time, potters may respond to increasingly diversified demands by consumers for prestige or labor-intensive vessels used in displays of status. Increases in status competition would be likely to have an impact on consumer demand for labor-intensive vessels. Potters should also adopt a strategy of simplification or increasing efficiency in production of some shape classes, particularly non-

Figure 3. Model of Change in Systems of Pottery Production In Relation to Increasing Cultural Complexity



prestige wares. There should be a change in organization of labor over time as well. Below, I discuss alternative strategies of producers and consumers in more detail.

Diversification

Potters are likely to adopt a strategy of diversification when there is an increase in sociopolitical differentiation with an increase in size and density of the consuming population. Two important aspects of cultural evolution are increasing population size and density, and increasing social differentiation (Flannery 1972, Wright 1978). Increases in population size and density coupled with increases in social differentiation are likely to cause more diversified demands for vessels by consumers (Rice 1984:256-7). Consumers may demand greater varieties of non-prestige and/or prestige wares. An increase in varieties of vessels desired by consumers of different social statuses is likely (Rice 1987:301).

Other factors may cause diversification in production as well. Decreases in available arable land, especially in conjunction with increases in population size and density, may force some households to make a living by other means such as pottery making (Arnold 1985:168, 196). This may cause a change from a household mode of production to one involving specialists. Or, there may be a change from one specialist mode to another.

Potters are likely to make changes in strategy of production if an element of competition is involved. As I discuss below, potters may resist change. Specialist potters in competition with one another for a growing and increasingly diversified consuming population should diversify production of prestige and non-prestige wares. Demand for a variety of goods gives potters incentive to compete (Foster 1965:55). Birmingham (1975) observes that competing potters in the Kathmandu Valley make a wide variety of vessels in order to please consumers. Competition between potters to diversify production may involve the harboring of secret technologies (Nicklin 1971:33). Competition among producers is intensified if there is an increase in number of work units specializing in pottery production.

There are three categories of archaeological evidence for diversification in production. The first is an increase over time in variety of paste, shape, and/or decorative classes. The second is a decrease in dimensional standardization. The third is a decrease in within-class (i.e., shape class) standardization with regard to secondary shape features and techniques of decoration. There may be evidence for one or more of these ceramic categories.

Two external factors may cause diversification of production of non-prestige (utilitarian) wares. One is changes in diet necessitating adoption of new methods for preparing, cooking, and/or serving food or drink (Rice 1984:246). For example, declining availability of arable land could stimulate farmers to grow new crops that are better adapted to poorer soil. Potters could respond by producing new forms and/or pastes for vessels used to prepare these new foods. A second causal factor is changes in ritual practices (Rice 1984:246-7). Change in household ritual practices could result from contact with another cultural group. Potters would respond by producing new form and/or decorative classes of vessels. However, high status families may adopt changes in diet and in ritual practices and also create a demand for changes in vessels (in form, paste, and/or decoration). Vessels used in public contexts would exhibit labor-intensive techniques.

Simplification

The strategy of simplification of production involves a decision to produce fewer varieties of ceramic classes defined in terms of paste, shape, and/or decorative techniques. The strategy of simplification may be caused by at least three types of external factors.

The first and more common situation involves two of the same causal factors that may stimulate diversification: increasing population size and density, and decline in availability of arable land. In this case potters are likely to compete for the increasing size of the consuming population by producing non-prestige wares as efficiently as possible.

There are potentially two types of archaeological evidence for simplification in this instance, in addition to decrease in variety of ceramic categories. The first is increase in dimensional standardization. The second is increase in within-class standardization, or varieties of size classes, decorative techniques, and secondary shape features within each shape class. Evidence for relative lack of labor input in production techniques such as decoration, forming, and firing may indicate efficiency in production as well. There is no incentive for potters to invest time and labor on classes of vessels with relatively low value to consumers. In the Kathmandu Valley, vessels regarded as "cheap" and "disposable" by consumers are made with a relative lack of labor input by specialist potters (Birmingham 1975:386). A similar situation has been observed in Veracruz, Mexico (Krotser 1974:133-4).

The third external causal factor is increasing social differentiation. Potters may also decide to produce some prestige wares more efficiently, to meet consumer demand. There should be evidence of an increase in dimensional standardization and/or within-class standardization of labor-intensive vessels. Prestige vessels will not exhibit evidence of lack of labor input. As defined in this study, they are produced by labor-intensive techniques.

If intensification of production, or efforts to produce greater quantities of vessels more efficiently, is successful there can be a feedback situation in which it is advantageous for potters to increase their efforts at intensification. For example, if the size of a distribution area increases, potters may respond by increasing their efforts at efficient production. Davis and Lewis (1985) conclude that when size of distribution area increased during the late Bronze Age on Crete, there was an increase in efficiently applied decorative techniques and an increase in standardization of shape.

Cultural stress from factors such as increase in warfare, famine, disease, or environmental degradation can force potters to simplify production to a great degree. These factors may cause the size of the population using and making pottery to decline dramatically. Also, potters would have less time, energy, and/or resources to spend on production. There should be a relatively large decrease in varieties of vessel classes (paste, form, and/or decoration) produced. Production of prestige wares should decline dramatically or cease. Relative lack of labor input in production should increase. Decoration is most likely to change (Rice 1987:464). There are two cases from the period of European contact in the New World that illustrate this process (Rice 1987:268-71). During the sixteenth and seventeenth centuries in central Mexico, decoration on Aztec pottery became simplified after population levels declined. Similarly, contact with Europeans caused disease among the Arikara of the North American Plains and population decreased. Subsequently, quality of surface finish on Arikara pottery declined.

Conservatism

Conservatism in production is likely, especially with respect to vessels that serve basic needs such as vessels used for household rituals (in private contexts), water jars, and cooking pots (Rice 1984:245-6). Potters are reluctant to change production methods when consumers resist change. Also, potters do not want to risk changing methods that have proven successful in producing vessels that serve basic needs. Aspects of production that have functional significance, i.e., paste and form, are least likely to change (Rice 1984:241).

CHANGES IN STRATEGIES OF CONSUMERS FOR PRESTIGE VESSELS

Researchers often ignore the main purpose of using pottery vessels in prehistoric societies: preparation, storage, and serving of food and drink. Because these activities have universal significance, attributes of pottery vessels can symbolize social relations. Two other ceramic studies that address this topic are Sinopoli (1986) and Dietler (1988). Sinopoli (1986) uses historic data to investigate how social relations are symbolized during activities involving food vessels in a medieval Hindu society. Dietler (1988) describes the social importance of drinking alchohol and the effect of importing foreign wine and drinking vessels on political economy during the French Iron Age.

Strategies for social manipulation have an impact on consumer demand for goods (Appadurai 1986:29). In a chiefdom, competition for maintaining and enhancing positions of status is common behavior. Status may be defined in terms of wealth, sex, age, political position, ritual position, genealogical relationship, or other variables. Status competition creates demand for craft items that have prestige value. This part of the model describes how people use pottery vessels that exhibit relatively great amounts of labor input during displays of status. Pottery vessels are on display as well as the food and alchohol that they contain.

Social value of goods varies with context of use (Douglas and Isherwood 1979). Pottery vessels for food and alchohol may be used in two kinds of social contexts: household consumption and consumption at inter-household social events. If display behavior with pottery is present in chiefdoms, it should take place most often in public contexts, such as inter-household social events. Social messages tend to be sent when they will be visible to relatively large, diverse groups of people (Wobst 1977:330). Ethnographic data on use of pottery vessels support this prediction. In the Yucatan, vessels with the greatest amount of labor input are those used in the most public areas (Lischka 1978:231).

In a chiefdom there are two types of behavior in which people may use inter-household social events involving food and/or alchohol to maintain or enhance positions of status. They are: 1) display of largesse, or generosity in giving food and/or alchohol to other people, and 2) conspicuous consumption, or display of personal consumption of food and/or alchohol. For these activities consumers demand containers exhibiting relatively great amounts of labor input in order to symbolize status. Displays of largesse and conspicuous consumption with labor-intensive vessels must have been common in prehistoric chiefdoms, given the extent they are mentioned in the ethnographic literature (discussed below).

During the transition from chiefdom to state there should be fluctuations in competition for positions of social status. Competition may increase, decrease, or remain stable. When competition increases, competing individuals or groups create an increase in demand for craft goods that symbolize status. Increasing size and density of population may be a causal factor. As societies increase in size and complexity, the need for people to communicate positions of status with material items increases (Rice 1984:257).

An increase in status competition should cause an increase in demand for pottery vessels to use in displays of largesse and/or conspicuous consumption, resulting in increased production of vessels differentiated in terms of labor input. Increased production from one phase to another may involve: making greater quantities of elaborated vessels with no change in method, using a greater variety of techniques for elaboration, and/or increasing the level of labor expenditure in making vessels.

A decrease in status competition causes a decrease in demand for pottery vessels used in displays of largesse and/or conspicuous consumption. This results in a decrease in production of elaborated vessels. One causal factor may be rejection of peaceful means of status competition by people in favor of increased warfare. However, a decrease in production of elaborated vessels could indicate that competitors decided to replace pottery vessels with a new type of craft good to symbolize status, rather than an actual decline in status competition. Changes in types of craft goods that serve as prestige items are likely as chiefdoms become more complex. Increases in production of status items tend to cause further increases. Competitors demand increasingly elaborated and different items for demonstrating superior status. This process cannot continue indefinitely; inevitably the system of production must stabilize or collapse.

On the basis of ethnographic data about use of containers (pottery and wooden vessels, baskets) during displays of largesse and conspicuous consumption, I expect to find a pattern showing a continuum of elaboration in labor input. At one end are vessels exhibiting relatively marked elaboration, and at the other, vessels that are relatively non-elaborated. The greater the social position of the consumers, the greater the elaboration. Vessels exhibiting a low degree of elaboration may represent attempts by non-elite consumers to acquire vessels that emulate those used by elites.

Labor-intensive techniques have been identified from ethnographic observation and experience of western potters. For example, it has been observed that large vessels require more labor input than smaller vessels (Reina and Hill 1978:246; DeBoer and Lathrap 1979:120). Also, thin-walled vessels produced by scraping require relatively great labor input (DeBoer and Lathrap 1979:120, Hagstrum 1986:16).

Displays of largesse

On the basis of ethnographic data summarized in Table 8, I expect that there may be evidence for up to four types of displays of largesse in prehistoric chiefdoms. Three types pertain to elites: 1) chiefs giving food and alchohol to political supporters, 2) other elites holding occasional feasts, and 3) rivalries of feast-giving by elites. The fourth type applies to elites and non-elites: providing food for participants at life-crisis ceremonies such as weddings and funerals.

The goal of elites in any display of largesse is to maintain or increase positions of status. Displays of largesse are displays of generosity in giving food and/or drink to relatively large numbers of people. This generosity is a manipulative tactic. A generous reputation is an important asset for social, especially political, status. Food and alchohol are gifts of great value. By receiving these gifts, people become indebted to the donor(s). In the first two types

Table 8. Display Behavior with Containers in Chiefdoms and Other Ranked Societies.

type of display	containers	area, reference
largesse, chiefs give food to political supporters	huge wooden troughs for serving taro	Polynesia (Firth 1965: 222)
	large quantities of serving baskets, over 100 in one feast	Polynesia (Firth 1965: 227)
	huge pottery serving vessels for porridge	Africa (Goody 1982: 91)
	huge cooking pots for porridge, very large serving baskets	Africa (Richards 1939:148)
high status people hold feasts	large quantities of pots for corn beer	Mexico (Pastron 1974:108)
	large cooking pots	Guatemala (Nelson 1981:122)
	large quantities of big cooking pots	Mexico and Guatemala (Hayden and Cannon 1984:175)

rivalries of generosity by high status people	large, elaborately decorated wooden baking frame for puddings	Melanesia (Oliver 1955:367)
	large cooking pots for taro pudding	Melanesia (Malinowksi 1922:171)
	huge wooden serving vessels	Melanesia (Davenport 1986:96, 98,99)
	large quantities of cooking pots	Melanesia (Oliver 1955:297)
	large quantities of beer apparently served in many pots	Africa (Washburne 1961)
largesse at life-crisis ceremonies	large cooking pots	Guatemala (Nelson 1981:113)
	large cooking pots	Philippines (Longacre 1985:344)
	large, decorated pots for serving food such as basins	Peru (Tschopik 1950:206)
	large quantities of cooking pots	Guatemala (Nelson 1981:111)

	porcelain food dishes, some with elaborate shapes, porcelain rice wine jars	Philippines (Solheim 1965:256, 258,281)
conspicuous consumption	large quantities of pots	Peru (Tschopik 1950:215-6)
	large quantities of pots	India (Miller 1985:74)
	diversity of pot forms	Peru (Tschopik 1950:215-6)
	diversity of pot forms	India (Miller 1985:73-4)
	chiefs use elaborately decorated wooden spit bowls	Hawaii (Earle 1987b:69)
	elaborately decorated pots for drinking corn beer	Peru (DeBoer 1984:551-4)
	size of calabash for drinking beer correlates with status	Africa (Washburne 1961)

of displays by elites, recipients are obliged to acknowledge the superior status of the donor(s). In the third type of elite display, recipients attempt to surpass previous displays of generosity. The purpose of displays of largesse at life-crisis ceremonies is to symbolize status of the hosting families.

The ethnographic data summarized in Table 8 indicate that there is a tendency to use particular functional types of vessels for different types of displays. Displays of largesse tend to involve vessels for cooking and serving food, and for preparing and serving alchohol. In displays of largesse by chiefs for political supporters, two types of elaborated containers are common: extremely large containers for cooking and serving food, and great quantities of containers for serving food. Among the Gonja of Ghana, women in the house of the chief cook and serve porridge in huge pots to people during the most important community festival. This act of generosity on the part of the chief ensures loyalty of supporters (Goody 1982:91). Among the Bemba of Rhodesia, chiefs give people who provide labor at their households large amounts of food. Porridge is cooked in huge pots and served in baskets that are about eight times larger than those used in daily life (Richards 1939: 148). The extremely large size of containers and great quantities used symbolize the unsurpassable largesse of the chiefs.

Feasts held by elites other than chiefs tend to involve vessels that are large in size, too. Among the Maya of Guatemala, lineage heads tend to own relatively large quantities of big fiesta pots (Hayden and

Cannon 1984:175). Also, the wealthier the landowner, the larger the size of fiesta pots owned (Nelson 1981:122).

Elites other than chiefs attempt to surpass previous displays of generosity in order to improve their positions of status. In Melanesia, men host feasts in order to humiliate particular rivals (Oliver 1955: 365-90; Davenport 1986:97-8). Again, very large containers as well as large numbers of them are used to prepare and serve food. The larger the size of vessel, the more expense was undertaken by the host (Davenport 1986:96,98). Among the Thonga of southern Africa, elite males compete with each other for supporters by giving away beer (Washburne 1961). Apparently, donors have large quantities of pots for brewing and serving.

When families provide food for participants of life-crisis ceremonies, they use vessels that are relatively less elaborated and show more varied methods of elaboration. If families do not have adequate resources, they borrow large pots (Nelson 1981:113) or food and labor (Longacre 1985:344). Or, they may use larger quantities of normal-sized pots (Nelson 1981:111). Vessels for cooking and serving may be large in size, elaborately decorated, have elaborate forms, and have fine paste.

Displays of conspicuous consumption

Displays of conspicuous consumption by elites and non-elites may take place at individual households and at inter-household events. People may use vessels designed for use by more than one person and/or individual-use vessels such as drinking cups. Ownership of a large quantity of pots and a great diversity of pots are two kinds of symbols of wealth and status. Another is use of elaborated cups for drinking alchohol. In Africa, for example, size of calabash (for drinking) correlates with status of consumer (Washburne 1961). Methods of elaboration are varied.

Display of personal consumption with elaborated drinking cups should be common given archaeological as well as ethnographic evidence. In Denmark, elaborately shaped drinking cups of metal and containers for alchohol (metal, ceramic) are associated with adult male graves from prehistoric chiefdoms (Kristiansen 1984:86-93). Display of personal consumption is evident, whether the vessels were made for consumption by the deceased in the after-life or by mourners at the funeral rites. In Germany, thin-walled drinking cups of pottery are also associated with adult male graves (Wells 1985:11-3).

The Chinese historical context

Historical records mention that bronze and some types of pottery vessels were used in displays of status during the Shang and Zhou dynasties. Apparently, displays took place in several social contexts. Bronze vessels were exhibited in burials, ancestral halls, and during feasts (Li Xueqin 1980:9). Table 9 describes types of displays mentioned in the literature. It appears that size, weight, shape, and decoration were important criteria, as well as quantity of vessels in use at one time. These examples provide additional support for my expectation that there should be evidence for display behavior, largesse and conspicuous consumption, with pottery during the Longshan Period.

Historical records suggest that one type of bronze vessel in particular, the _ding_ cauldron, was often used in displays of status. It is possible that at least some large _ding_ were used in displays of largesse. For example, two bronze _ding_ that have been found are large enough in volume to cook an ox (Li Xueqin 1980:10). Very large _ding_ may have symbolized power and authority (Chang 1983b:95). Unfortunately, details about the social contexts in which large _ding_ were used are lacking. _Ding_ cauldrons may have been used during the types of events in which displays of largesse are common in chiefdoms: leaders feeding political supporters, other elites holding feasts, rivalries of generosity by elites, and families feeding participants at life-crisis ceremonies.

Table 9. Display Behavior With Containers: the Chinese Historical Context

type of display	characteristics of vessels
symbols of rank	possibly a hierarchy of bronzes according to size, weight, shape, decoration, inscriptions, Shang Dynasty (Chang 1980:207)
largesse?	huge bronze _ding_ cauldrons: one at 875 kg, 133 cm in height, 110 cm in length; two vessels 1/2 this size; each has the capacity to cook an ox, Shang Dynasty (Li Xueqin 1980:10)
symbols of rank	different sizes and quantities of bronze _ding_ cauldrons correlate with rank, Zhou Dynasty (Li Xueqin 1980:10)
demonstration of power	large bronze _ding_ used to boil alive a foreign leader, Zhou Dynasty (Li Xueqin 1980:10)
ceremony to maintain positions of rank by elite males, Shang and Zhou Dynasties	apparently bronze and pottery eating and drinking vessels, quantity of food vessels correlates with age (Cooper 1982:107-14)

ceremony of thanksgiving by elite males, and other drinking ceremonies, Shang and Zhou Dynasties	apparently bronze and pottery drinking vessels (Cooper 1982:107-14)
general, Shang and Zhou Dynasties	apparently quantity of bronze and pottery food serving dishes correlates with rank (Chang 1978:131)

It appears that there were displays of conspicuous consumption with containers during the Shang and Zhou dynasties, too. One text mentions that quantity of vessels for serving food correlates with age of consumer. Also, drinking vessels are associated with elite males (Cooper 1982:108-14). Quantity of vessels for serving food may correlate with rank as well (Chang 1978:131).

CHANGE IN MODE OF PRODUCTION

The first topic discussed in this section is typologies for modes of production. Second, hypotheses in the Chinese and western archaeological literature for mode of production during the late Neolithic period are discussed. Third, expectations for change in mode of production on the basis of ceramic variability are described. There are few test implications that have been derived from ethnographic data.

There are several typologies for mode of ceramic production in the archaeological literature. Four modes of production have been defined on the basis of ethnographic data by van der Leeuw (1977, 1984) and Peacock (1981, 1982:8-10): 1) household production (non-specialist), 2) household industry, 3) individual workshop industry, and 4) nucleated workshop industry. Other researchers make a further distinction between attached and independent specialization (Earle 1981:230, Brumfiel and Earle 1987:5). Independent specialists produce goods for a general population of consumers. Attached specialists, sponsored by elites, produce prestige items exclusively for elite consumption. Santley et al. (1989:108) use the term "tethered specialization" to refer to one type of attached specialization. Two recent studies employ more complex typologies. Costin (1986) focuses on distinguishing between modes involving independent and attached specialists. Sinopoli (1988) defines modes that pertain specifically to state-level societies.

This study employs the simpler typology of modes defined by van der Leeuw (1977, 1984) and Peacock (1981, 1982). Given a chiefdom level of cultural complexity, the first three modes are potentially applicable: household, household industry, and individual workshop industry. Nucleated workshop industry is associated with urbanism and fully developed market economies (Rice 1987:184). The study emphasizes identification of prestige (labor-intensive) versus non-prestige wares rather than identification of attached versus independent specialization.

Rice (1987:187) suggests that the household industry mode encompasses a great deal of variability. It is likely that modern ethnographic societies with household industry do not represent the range of variation that probably existed among prehistoric chiefdoms. In this study I propose to define two types of household industry, "simple" and "complex".

"Simple household industry" refers to the standard definition of household industry involving female producers using a simple technology.

Due to factors such as poor agricultural land, families attempt to supplement their incomes by making pots (Rice 1987:184). The Fulani of Cameroon are often regarded as exemplifying the household mode of production. It is not likely that this group represents the only kind of household industry in prehistory. The Fulani regard potting as a low status, undesirable activity. Containers made of modern materials such as plastic or metal are preferred (David and Hennig 1972:4,17).

"Complex household industry" is similar to the individual workshop industry mode as defined by van der Leeuw (1977, 1984) and Peacock (1981, 1982). In both modes, specialist producers are men. Potting is the major source of income. The former mode involves production in houses, and the latter, in workshops. The individual workshop mode is characterized by greater intensification of production. The ethnographic case described by Miller (1985) for a village in central India is a useful illustration of "complex household industry". Six houses, organized by men, produce vessels for others (1985:36,209). Vessels are either sold in houses or in regional markets, and payment is made with grain or cash (1985:86). Potters on the island of Thassos in Greece exemplify individual workshop industry (Peacock 1981:189-190). Two male potters, investing a considerable amount of resources in technology, produce vessels for all other residents.

Some Chinese and western researchers expect that there is increasing efficiency in ceramic production during the late Neolithic period. They imply that a workshop industry mode existed.

Song, Li, and Du (1983:273) state that there were gradual improvements in techniques of production and that scale of production increased significantly. They envision a system in which families specialized in pottery making. Li and Cheng (1984:14) agree with this conclusion. Their illustration (Li and Cheng 1984:7) of two men working on a wheel (one turning, one forming) seems equivalent to individual workshop industry because large output is implied.

The term that Keightley (1987) applies to late Neolithic pottery in China, "prescriptive production", seems to refer to a workshop mode of production. The term originates with Franklin (1983), designed to describe organization of bronze production during the Shang dynasty. It indicates a highly organized division of labor that regularly produces a large volume of output. According to Franklin (1983:96), with prescriptive production there is "an essential predictability", and "no room for surprise". Also, there is standardization of form and material (Franklin 1983:97). By expecting the presence of overseers who plan all steps of production, Keightley implies that pottery vessels should exhibit a high degree of standardization (1987:107).

There are serious problems in identifying modes of production on the basis of ceramic data. Few test implications for modes have been developed, partly due to the limited ethnographic sources providing relevant information (Rice 1987:204-5). Studies involving state-level societies have had the most success in identifying mode of production. There is often more than one source of nonceramic data available such as direct evidence of workshops and textual data describing organization of production (see Sinopoli 1986, 1988; Davis and Lewis 1985; Benco 1987, 1988; and Beaudry 1984).

It is difficult to determine whether changes in degree of standardization or diversity indicate change from one mode to another, or simply change within a mode. The different conclusions reached in two recent studies illustrate this dilemma. Milanich et al. (1984:132-6) conclude that a certain level of standardization and diversity represent specialized production in the Weeden Island Culture of northern Florida. However, Kaiser (1984:292-5) concludes that increases in diversity indicate intensification of production within a non-specialist or household mode.

There are a limited number of observations of pottery production in traditional societies that provide support for the hypothesis that increases in standardization and diversity indicate development of or increase in specialization (Rice 1981, 1987:202). There is some indication that a progression from one mode to another is characterized by an increasing degree of standardization and diversity (Table 10). Unfortunately, most observations of traditional societies pertain to the extreme ends of the continuum, the household and nucleated workshop industry modes.

Only one ethnoarchaeological study with the explicit purpose of examining variability in vessels in relation to modes of production has been published to date (Longacre et al. 1988). It supports the

Table 10. Identification of Mode of Production: Ethnographic Data on Ceramic Variability.

ceramic variability	ethnographic observation
dimensional standardization	Longacre et al. (1988) show that pots made in a nucleated workshop industry mode are much more standardized in shape and size than pots made in a household mode
	Balfet (1965) notes that pots made in a nucleated workshop industry mode are highly standardized in shape and size compared to pots made by semi-specialists
within-class standardization	none
diversity	Longacre et al. (1988) show that there is a greater variety of size classes of pots made in a nucleated workshop industry mode than in a household mode
	van der Leeuw (1984) suggests that diversity of forms increases with complexity of mode

hypothesis that a high degree of standardization represents a complex specialist mode of production. The authors conclude that vessels made among full-time specialists (representing a nucleated workshop industry) in the Philippines, the Paradijon, are much more standardized in shape and size than vessels made in a household mode of production by the Kalinga (1988:111).

One other study demonstrates with quantitative data that potters in a nucleated workshop industry mode, in Egypt, produce vessels that are highly standardized in form (Lacovara 1985:56). Balfet (1965:166) makes a comment about dimensional standardization and mode of production that is later supported by the results of Longacre et al. (1988). She notes that vessels made by full-time specialists in north African workshops are highly standardized in shape and size. Also, vessels made by semi-specialists (mode not specified) are less standardized (1965:170).

Longacre et al. (1988:111) also observe that a greater diversity of size classes of cooking pots is produced in the nucleated workshop mode than in the household mode. This finding supports the suggestion by Rice (1981, 1987:202) that diversity of ceramic categories increases with complexity of productive mode. In this vein, van der Leeuw (1984:757-60) suggests that diversity of vessel forms increases in the progression from household production to each type of specialist mode.

If there is archaeological evidence for efficiency in production, it is likely that specialists are represented (Brumfiel and Earle

1987:5). Factors such as increasing population density can cause independent specialists to intensify production (Earle 1981:230). However, increasing efficiency or simplification in production over time may not necessarily entail a change in mode of production.

SUMMARY

The model tested in this study outlines potential changes in strategies of ceramic production in relation to increasing cultural complexity in chiefdoms. There are three strategies of production: diversification, simplification, and conservatism. There may be evidence for more than one of these strategies within an assemblage. After Rice (1981), it is hypothesized that potters should adopt a strategy of diversification for one or more shape classes as sociopolitical complexity increases. Potters should also adopt a strategy of simplification or increased efficiency for some shape classes, and there should be ceramic evidence for a change in mode of production. The model describes some external causal factors that can have an impact on production strategy such as increasing population size and density. One important causal factor internal to the system of production is competition among potters in response to consumer demand for an increasing variety of prestige (labor-intensive) and non-prestige vessels.

The model also describes how people may use pottery vessels in order to display status. Elites and non-elites may undertake displays of largesse and/or conspicuous consumption. These displays are common in ethnographically-known chiefdoms. The model predicts that an increase in status competition creates demand for a greater variety of prestige vessels. Also, some types of display tend to involve certain functional classes of vessels. For example, displays of largesse tend to involve very large containers. Finally, historical texts from the Shang and Zhou dynasties in China suggest that bronze and pottery vessels may have been used for displays of largesse and conspicuous consumption. Therefore, there is even more reason to expect that these displays were taking place during the Longshan Period.

CHAPTER 4. ANALYSIS OF SHAPE CLASSES AND HYPOTHESES ABOUT FUNCTIONAL TYPES

INTRODUCTION

This study relies on descriptions of shape classes in archaeological reports for testing the model of ceramic change. The test requires explicitly defined and distinct shape classes for each site. Therefore, it is necessary to evaluate the individual shape classes defined in reports. When examining vessels in the field, it became apparent that some shape classes might require redefinition, either by splitting into more groups or lumping with other groups. Another necessary step before testing the model is discussing the types of information on pottery presented in reports as well as information on ceramic function. These topics are addressed in a separate chapter, since they have not been treated extensively in the western literature on Chinese archaeology.

The chapter consists of four sections. The first section is a description of traditional terms used to designate shape classes of vessels in Chinese archaeological reports. The second section describes kinds of ceramic data included in Chinese Neolithic site reports. The third section consists of the evaluation of shape classes defined in archaeological reports for Hougang, Baiying, Meishan, and Lujiakou. In the fourth section, hypotheses about vessel function are discussed.

TRADITIONAL TERMS FOR DESIGNATING SHAPE CLASSES

Archaeologists in China use a traditional set of terms to designate shape classes of containers. These terms may refer to pottery, bronze, porcelain, wooden, or lacquer vessels. They originate from two sources: 1) ancient texts and 2) modern usage (An Zhimin 1953:73). According to Chang (1981:158), many ancient terms date to the Song Dynasty (A.D. 960-1279). Song scholars adopted terms from older, classic texts that denoted different shapes of bronze vessels. One such term is _ding_ cauldron, mentioned in Chapter 3. Modern terms include _bei_ cup and _wan_ bowl.

Table 11 lists published definitions for traditional terms designating shape classes of vessels. All of the forms listed are represented in Longshan sites. As the table indicates, some terms such as _hu_ pot originate from ancient texts and are still used today. Given substantial continuity in vessel shape over time in China, archaeologists have seen advantages in using the traditional terms to describe Neolithic as well as vessels from historic period sites. However, problems have been encountered in using these terms. As in many areas, researchers classify vessels by subjective assessment of similarity. Archaeological reports do not give an indication that quantitative methods are used in classification. As a result there is some confusion regarding definition of terms and assignment of vessels to classes (see Chang 1981:161). Authors of different reports use different definitions

Table 11. Published Definitions for Traditional Terms Describing Shapes of Vessels Found in Longshan Sites.

ancient vessel shapes, terms no longer used:

dou	Chinese-English Dictionary (1979): ancient stemmed cup or bowl Zhang (1983): hemispherical bowl with high stem and spreading foot, a container to serve food Li Xueqin (1980:11): meat container, may have a deep belly and lid, or shallow bowl Chang (1978:128): during the Shang Dynasty, vessel of pottery, only, to serve meat dishes
ding	Chinese-English Dictionary (1979): ancient cooking vessel with two loop handles and three or four legs Zhang (1983): three or four legged cauldron for cooking meats and cereals Li Xueqin (1980:8): vessel to cook meat with a deep belly and three or four legs Chang (1981:160): a specific term that refers to a vessel with three solid legs
gu	Chinese-English Dictionary (1979): ancient wine vessel, beaker, goblet Zhang (1983): goblet with broad lip, long narrow stem, and flared base, for wine Chang (1981:162): a generic term for a vessel to warm wine
gui	Chinese-English Dictionary (1979): ancient pitcher with three legs (pottery only)
jia	Chinese-English Dictionary (1979): ancient tripod wine vessel with a round mouth Zhang (1983): round tripod vessel for wine with handle and capped columns Li Xueqin (1980:14): wine goblet, moderately large belly, sometimes with lid Chang (1981:162): a generic term for a vessel to serve wine

li — Chinese-English Dictionary (1979): ancient tripod cooking vessel with hollow legs
Zhang (1983): cauldron for cooking meats and cereals
Li Xueqin (1980:10): a cooking vessel with pouch-like hollow legs
Chang (1981:162): a generic term for a food vessel

lei — Li Xueqin (1980:16): an urn-like vessel that is fairly tall and narrow

xian/yan — Zhang (1983): steamer for vegetables and cereals
Li Xueqin (1980:10): a tripod steamer with pouch-like legs, upper part is like a ding and has a rack at the base
Chang (1981:161): a specific term for a tripod food vessel

zeng — Chinese-English Dictionary (1979): an ancient earthen utensil for steaming rice

zun — Chinese-English Dictionary (1979): a kind of ancient wine vessel
Zhang (1983): cup for drinking or warming wine
Li Xueqin (1980:15): a wine container (illustration shows a vessel with wide orifice, carinated body, splayed foot)
Chang (1981:161): a generic term for wine vessels

zuo — Guo (1981:136): a stand for other vessels known from the later Zhou Dynasty

terms denoting ancient and modern vessel shapes:

bei — Chinese-English Dictionary (1979): cup
Zhang (1983): wine vessel, cup

bi — Chinese-English Dictionary (1979): grate or grid for steaming

<u>bo</u>	Chinese-English Dictionary (1979): earthen bowl
<u>bu</u>	Chinese-English Dictionary (1979): vase Li Xueqin (1980:15-6): short and squat urn-like vessel for holding wine (illustration page 17 shows a large ring foot)
<u>gang</u>	Chinese-English Dictionary (1979): vat, jar, crock, for holding water, pickled vegetables, etc.
<u>guan</u>	Chinese-English Dictionary (1979): jar, pot, for jam, tea, water, etc. Hansford (1954): a substantial vessel moderately contracted towards the neck, a jar Chang (1978:127): a storage vessel made of pottery during the Shang and Zhou Dynasties
<u>gai</u>	Chinese-English Dictionary (1979): lid, cover Hansford (1954): cover
<u>he</u>	Chinese-English Dictionary (1979): box, case Hansford (1954): a small box with fitted cover, often circular in shape
<u>hu</u>	Chinese-English Dictionary (1979): kettle for water, pot (for tea, etc.) Zhang (1983): jar for wine of various shapes - round, rectangular, compressed Li Xueqin (1980:16): a wine container of various shapes - round, rectangular, compressed Chang (1981:161): a specific term for a wine vessel Hansford (1954): describes several different shapes and functions such as warming wine, tea
<u>lei</u>-<u>bo</u>	term from An Jiayuan (1986), called <u>deng</u> <u>lu</u> by most writers to mean strainer, filter; from the common meaning of the two words, for example in The Chinese-English Dictionary (1979)

pan — Chinese-English Dictionary (1979): plate, dish, tray
Zhang (1983): wide shallow bowl for holding water to use in washing or ceremonial ablutions, usually with high ring foot and handles
Li Xueqin (1980:19): a water vessel for ceremonial ablutions, used with he pitcher before the middle Zhou period
Chang (1981:162): a generic term for a water container

pen — Chinese-English Dictionary (1979): basin, tub, pot for water, flowers, etc.
Hansford (1954): pot, tub
Chang (1981:162): a generic term for a water container

ping — Chinese-English Dictionary (1979): bottle, vase, jar
Hansford (1954): vase or bottle; vessels with narrow necks and swelling bodies

wan — Chinese-English Dictionary (1979): bowl
Hansford (1954): small bowl used for eating or drinking tea

weng — Chinese-English Dictionary (1979): earthen jar for water, pickled vegetables, etc.
Hansford (1954): like guan, a jar moderately contracted towards the neck

yu — Chinese-English Dictionary (1979): a broad-mouthed vessel for holding liquid such as a spittoon for terms. This problem is compounded by the fact that there is often a great variety of vessel shapes in ceramic assemblages, as Medley (1976:24) points out. A class of vessels described by one term may include more than one ceramic form.

Table 11 shows that one reason for this confusion is a lack of specificity in the definitions for terms. Chang (1981) points out that only some of the ancient terms were meant to refer to specific forms of bronze vessels; most terms are generic. The other terms should be considered generic, too. The problem of nonspecific terms for describing vessel shape is not limited to Chinese archaeology. As Fournier (1981) shows, several terms used in modern English such as "cup" and "jar" are not precise.

Problems of this kind in classification are inevitable when researchers attempt to apply formal types on a widespread basis. The traditional terms should be considered as starting points for establishment of classes that suit particular research problems, rather than formal types with standardized definitions to fit all cases.

Table 11 illustrates another problem, that the traditional terms refer to vessel function as well as morphology. Terms with functional implications are not useful on a widespread basis, because vessel function can change over time and space. It should not be assumed, for example, that vessels of a given form were used for the same purpose during the Neolithic and historic periods, especially when different raw materials (i.e., pottery and bronze) are involved. Functional aspects of the traditional terms should be considered as hypotheses on the basis of historical analogy, not fact. As the last section of this chapter shows, in some cases archaeological data do not provide support for the traditional definitions of function.

Scholars in the West should realize that Chinese researchers have employed a variety of methods for classifying vessels using the traditional terms; i.e., subdividing the basic categories of shape. Classification procedures used by Li Chi (1956) for pottery at the Shang site of Xiaotun provided a standard for later archaeological reports, as Li Chi himself points out (1977:138). For the Xiaotun pottery, Li Chi developed a paradigmatic classification procedure, dividing the assemblage into successively finer classes with lower body shape as the first division, and orifice size as the second. For the late Neolithic site of Chengziyai, Li Chi et al. (1956) describe a similar classification system that is based on differences in vessel openings and legs.

In 1953, An Zhimin stated that each worker devises his own method of using the traditional terms (1953:73). This statement is still applicable to recent archaeological reports.

Authors of Neolithic site reports often use three terms to describe vessel shape. Xingzhuang are broad categories of shape such as ding and bei. Xing are subtypes of xingzhuang, usually denoted by capital letters such as "A" and "B". Shi are subdivisions of xing and referred to as "styles". They are always designated by Roman numerals such as "I" and "II". Styles are usually defined by attributes of shape; occasionally attributes of decoration are used as well (Yan 1985:34). Classification is undertaken primarily for one purpose: to arrange vessels in a detailed chronological series, using the shi styles. It is a tool used primarily for one type of research problem: description of culture history. Because traditional terms are used on a widespread basis for this single purpose, archaeologists in China actually work with typologies, or leixingxue, rather than establishing classes to use for specific analyses, or leibie (Yan, personal communication, 1987b).

My evaluation of classification procedures concentrates on definitions of xingzhuang and xing given in reports. The shi stylistic groups, usually defined on the basis of relatively minor shape attributes, tend to be inappropriate for the research problem at hand.

KINDS OF CERAMIC DATA IN SITE REPORTS

There are three factors that must be considered when interpreting ceramic data in Neolithic site reports. First, formats of describing vessels can vary substantially. Table 12 lists formats of describing vessels in the Hougang, Baiying, Meishan, and Lujiakou site reports. The authors of the Hougang and Lujiakou reports use similar formats. For example, they group vessels according to xingzhuang, xing, and shi

Table 12. Formats of Describing Vessels in Site Reports.

site report	method
Hougang (Anyang Archaeo logical Team, IA, CASS, 1985)	pots from all phases grouped together into major shape classes (xingzhuang), subtypes (xing), and styles (shi). totals for each major shape class not stated for individual phases, but totals given for site as a whole
Baiying (CPAM of Anyang District, Henan Province 1983)	pots first separated by phase, then by type of paste and surface color, then by form according to major shape class (xingzhuang) and style (shi), only. styles can represent major or fine distinctions in form. vessels of one shape class may be described in separate sections. totals of each major shape class given for each phase
Meishan (Second Henan Archaeological Team, IA, CASS 1982)	pots described for each phase according to major shape class (xingzhuang) and style (shi), only. totals for quantities of vessels per phase or in the site as a whole not stated

Lujiakou (Shandong Archaeological Team, IA, CASS and the Art Museum of Weifang County, Shandong Province 1985)	pots from all phases grouped together by major form (xingzhuang), subtype (xing), and style (shi), but major forms are sometimes grouped by type of paste and surface color, and styles may represent major differences in shape. totals provided for site as a whole but not for each phase

styles. The authors of the Baiying and Meishan reports do not define <u>xing</u> subgroups of shape.

Reports tend to lack information that is relevant to research goals other than establishment or refinement of culture history. This situation creates problems for the present study. For instance, reports may state the total number of vessels for a given major form (<u>xingzhuang</u>) identified at sites, but not the number of vessels from each phase. This is the case for Hougang and Lujiakou. As discussed in Chapter 5, it is possible to estimate these figures.

Another important factor in interpreting descriptions of vessels in Chinese site reports is that only whole vessels or sherds with a recognizable form (i.e., <u>xingzhuang</u>) are described in any detail. While some of these vessels were originally recovered in one piece, most were broken; technicians skillfully reconstructed them with plaster. Sometimes reports summarize different types of paste and decoration found on sherds that cannot be used in reconstruction. However, they do not provide separate summaries for different phases.

The most serious problem with respect to this study is that reports only provide descriptions of vessels that are considered representative of a given style (<u>shi</u>), or major form (<u>xingzhuang</u>) in cases when no styles are defined. For example, a report may give a total of ten <u>ding</u> cauldrons and describe only three, one vessel from each style.

Thus, samples of vessels described in Neolithic site reports represent an even greater theoretical distance from an original systemic context (as defined by Schiffer 1976) than samples described in most western reports. This situation can be described by four levels, beginning with the systemic context (Table 13). The last two levels pertain to Neolithic site reports in particular.

In recent years western archaeologists have made efforts to describe how vessels excavated from sites represent a distorted picture of the original systemic context (e.g. Deal 1983, 1985; Hayden and Cannon 1983). They have pointed out how discard behavior affects the kinds and quantities of vessels recovered in archaeological contexts. This topic is discussed further in Chapter 6.

Vessels described in Neolithic site reports represent an artificial sample of the archaeological context. Because this study relies on ceramic data from site reports, conclusions about changes in production and inferred use of labor-intensive vessels must be regarded as preliminary. It is not entirely clear how well samples of vessels described in the Hougang, Baiying, Meishan, and Lujiakou site reports represent the population of vessels from the archaeological context.

An additional concern is that most shape classes are represented by very small samples of vessels. This problem is alleviated to some extent by the fact that I was able to examine several vessels in addition to those that are listed in the reports as representative of styles. In the analysis of shape classes, I describe these vessels as

Table 13. Schematic Representation of Levels in Interpreting Samples of Pottery Described in Chinese Neolithic Site Reports

<u>level 1</u> systemic context	vessels in use by households: curated, recycled, discarded. several discard areas; provisional or temporary, and final (Deal 1983, 1985)
<u>level 2</u> archaeological context	abandonment of households, eventually the whole community; type of abandonment affects kinds and quantities of vessels found in excavation (Deal 1983). recovery of whole and partially broken vessels, and sherds
<u>level 3</u> Neolithic site reports	only vessels that are whole or reconstructed, or large sherds with recognizable form (<u>xingzhuang</u>) are counted in totals
<u>level 4</u> Neolithic site reports	only vessels considered as representative of major forms (<u>xingzhuang</u>), subtypes (<u>xing</u>), or styles (<u>shi</u>) are described

"unknowns", since they are not mentioned in reports. I incorporate these vessels in my analyses if the major shape class (xingzhuang) such as wan bowl or bei cup is obvious. Also, I ensure that the quantity of vessels in my samples for major shape classes (with the "unknowns" added) matches the figures given in reports.

ANALYSIS OF SHAPE CLASSES IN SITE REPORTS

Some reports make direct statements about criteria archaeologists used to define individual classes of vessels. These statements are important because they refer to the total range of excavated vessels. They are expressed in qualitative terms; referring, for example, to a large belly and wide mouth. When appropriate I evaluate these statements by quantitative methods, referring to specific dimensions of vessels such as maximum diameter and rim diameter. In some cases examination of drawings and photographs in reports is sufficient to determine whether classes are distinct. When there is no explanation of criteria used in defining shape classes, I am limited to making evaluations on the basis of variability that is apparent in the samples of vessels described in reports.

In many cases the classes defined in reports are distinct. The only change necessary, if any at all, is re-assignment of a few vessels to more appropriate classes. However, in some cases I conclude there is no appreciable difference between established classes. Thus it is necessary to lump classes together. At times it is necessary to reclassify vessels, defining three forms, for example, when there were two originally.

Methods of analysis

There are a variety of approaches to classification of vessels by means of morphological attributes in the western archaeological literature. This study is concerned with establishing etic rather than emic classes, or devised (versus folk) classes in the terminology of Rice (1987). Descriptions of emic classification systems include Kempton (1981) and Kaplan and Levine (1981). Also, this discussion concerns classification of whole vessels rather than sherds. Other archaeological studies with this goal that are particularly relevant here are Sinopoli (1988), Barnes (1986), Froese (1985), Hardy-Smith (1974), and Whallon (1982). The literature indicates that there are two critical steps in classification: 1) selection of variables to define classes and 2) selection of statistical techniques for establishing classes.

Several studies have demonstrated the effectiveness of using ratios describing major vessel proportions in classification (Barnes 1986, Hally 1986, Sinopoli 1986, Froese 1985, Whallon 1982, and Hardy-Smith 1974). Ratios are more useful in identifying major differences in shape rather than single dimensions, particularly when whole vessels are analyzed (Barnes 1986:474; Whallon 1982:151-4, Hardy-Smith 1974:5). Also, it is important to identify different size classes for each morphological class of vessels using dimensions such as height (Barnes 1986:474, Hardy-Smith 1974:5). This classification method is adopted here, for reasons of practicality with respect to small samples as well as effectiveness.

Some studies employ large numbers of ratios for individual vessels (e.g., Froese 1985, Shennan and Wilcock 1975). This analysis uses measurements taken in the field and measurements calculated from scale drawings of vessels in reports. Time constraints and difficult conditions in the field made it impractical to take large numbers of measurements on each vessel. Likewise, it is not feasible to accurately calculate large numbers of dimensions from scale drawings in reports. Reliable results may be obtained only for major dimensions. Restriction to major dimensions should not undermine the analytical results, however. At least one study concludes that only a few key ratios are needed to distinguish between vessel shapes (Shennan and Wilcox 1975:27). Another complex method of classification considered infeasible for this study involves principles of solid geometry (e.g., Ericson and Stickel 1973; Shepard 1976; see Rice 1987:219-20).

Ratios and individual dimensions with formal-functional significance are used here to evaluate shape classes and define new ones when necessary (Table 14). There is a need for more ethnoarchaeological research examining the relationship between form and function. The few

Table 14. Ratios and Individual Measurements with Formal-Functional Significance Used in Analysis of Shape Classes.

ratio or measurement	significance
height and maximum diameter (HT, MXD)	size; ethnographic data indicate that many shape classes of vessels have more than one size class (David and Hennig 1972, DeBoer and Lathrap 1979:105, Pastron 1974:103, Longacre 1981:53) transportability (Rice 1987:226)
maximum diameter/ height (MXD/HT) or maximum diameter/ height of orifice diameter, or body height (MXD/ODHT)	overall shape and stability (Hally 1986:278); ethnographic data indicate that tall and thin vessels (i.e. those with smaller values of MXD/HT) tend to have a primary function of long term storage for dry goods or long term storage for liquid staples (Henrickson and McDonald 1983:632,633); relatively short and squat vessels (with larger values of MXD/HT) tend to be used for temporary storage of dry goods or for cooking (Henrickson and McDonald 1983:632, 631)
orifice diameter/ base diameter (OD/BD) or rim diameter/ base diameter (RD/BD)	stability; Ericson et al. (1972:89, 90,94) propose that vessels with relatively large values are more stable
maximum diameter/ base diameter (MXD/BD)	stability; proposed by Hally (1986:278)

orifice diameter/height (OD/HT), or rim diameter/height (RD/HT), or orifice diameter/height of orifice (OD/ODHT)	accessibility; proposed by Hally (1986:280), ethnographic data indicate functional significance of orifice size and vessel volume (Smith 1988:914), also that vessels for dry storage tend to have a small orifice and large volume, and that eating dishes tend to have a large orifice and small volume (Smith 1985:300,301)
orifice diameter/maximum diameter (OD/MXD), or rim diameter/maximum diameter (RD/MXD), or neck diameter/maximum diameter (ND/MXD)	accessibility; ethnographic data indicate that unrestricted vessels have larger values and restricted vessels have smaller values (Rice 1987:212), vessels for eating tend to be unrestricted and have larger values (Rice 1987:236)

studies that have been published include Henrickson and McDonald (1983) and Smith (1988, 1985). The functional significance of many ratios and single dimensions is not clear.

Form and function are not directly related; a given vessel form may be used for more than one purpose (Rice 1987:224). It is more profitable to define functional types on the basis of attributes other than morphology such as type of paste and presence of residues from use, as discussed in the final section of this chapter.

A number of statistical techniques, of varying complexity, have been used in classifications of vessel shape. Relatively complex techniques such as principal components analysis and cluster analysis are feasible when large data sets are available, in terms of quantity of cases and variables (see Sinopoli 1986, Froese 1985, Whallon 1982, Shennan and Wilcox 1975, Rice and Saffer 1982). It is not practical to use complex statistical techniques in this analysis, since only small samples of vessels and measurements are available.

Furthermore, the purpose of analysis is evaluation of previously established shape classes on the basis of key criteria either mentioned in reports or apparent from observation of vessels. It is not possible to totally re-classify a significant quantity of vessels that are clearly representative of the population of vessels recovered during excavation, i.e., to define all major shape classes or _xingzhuang_ such as _ding_ and _li_. It is more feasible to evaluate existing classes using relatively simple statistical techniques. Also, multivariate techniques such as cluster analysis would not be able to indicate clearly whether previously established classes should be combined into one class. For example, a cluster analysis of two sub-classes (i.e., xing such as A, B) of guan jars would result in a number of options for grouping vessels.

When sample sizes are adequate, I use techniques of exploratory data analysis, or EDA (Hartwig and Dearing 1979, Shennan 1988), primarily scatterplots as well as stem and leaf displays indicating ranges of measurements and median values. Traditional simple statistical techniques such as histograms do not describe distributions of measurements as completely (Hartwig and Dearing 1979).

More than one study has successfully identified shape classes by means of scatterplots (see Barnes 1986, Hardy-Smith 1974). I try a number of combinations of variables and select the plots that most clearly depict distinct groups, ensuring that the resultant classes are logical given variation among vessels observed in the field and apparent from information in reports (descriptions, drawings, photographs). Analyses were conducted with the computer programs SYSTAT and SYGRAPH (Wilkinson 1988a, 1988b).

When sample sizes of vessels permit, I employ nonparametric significance tests to evaluate existing classes and to define new ones when necessary. Nonparametric significance tests are appropriate when normal distributions cannot be assumed and when sample size is small (Siegal and Castellan 1988). I adopt a rejection level of 0.01 for the nonparametric tests. I prefer to use a relatively conservative criterion for rejecting the null hypothesis that there is no significant difference between shape classes, for concluding that different shape classes are present. Strict rules for defining groups are necessary, given that small samples are used in the analyses. Otherwise, perceived differences between vessels could merely represent the range of variation for one shape class.

Measurements on individual vessels, whether taken directly or calculated from scale drawings in reports, are rounded to one decimal place (i.e., 5.6 cm, 5.7 cm, etc). If vessel shape was uneven, I took the maximum measurement for a given dimension. Some measurements refer to the interior portion of vessels: orifice diameter, neck diameter, and maximum diameter.

When calculating dimensions from scale drawings of vessels in reports, it was not necessary to determine height and rim diameter. This information is usually given in reports, designated as <u>gao</u> (height) and <u>koujing</u> (rim diameter). These data made it possible to check the accuracy of calculated measurements from different scales. I compared my calculated measurements with the known ones, a procedure which detected errors in report measurements in a few cases. Occasionally I did random checks to compare my calculated measurements with those I had taken in the field. The majority of measurements used in the following analyses, however, were taken directly from vessels.

Results

This section briefly describes results from the analyses of shape classes defined in the Hougang, Baiying, Meishan, and Lujiakou site reports. For details describing original shape classes accepted and new classes established, see Appendix A (Tables 36-37, 39-44; Table 38 gives results of nonparametric significance tests for vessels from Hougang). This discussion focuses on comparing the shape classes defined in reports to the traditional terms as described in Table 11.

The evaluation of shape classes was more successful for Hougang than the other sites. There are larger samples of vessels, including vessels I examined directly and those illustrated in the report. Also, the report provides more statements about criteria for establishing classes. It was often difficult to evaluate the shape classes at Baiying and Lujiakou, because the primary method of classification is color and relative texture of paste rather than shape. Vessels in a given shape class are often described in different sections of these reports. A problem with the analysis of pots from Meishan is that only a small number of vessels were seen.

A shape class (xingzhuang) such as guan jar may refer to one form, or a number of forms (Table 15). These forms often differ from site to site. It is clear that the traditional terms should be regarded as generic. My proposed definitions for major shape classes of vessels in

Table 15. Summary of Results from Analysis of Shape Classes at Hougang, Baiying, Meishan, and Lujiakou.

("old" = original class(es) accepted, "new" = new classes established; "(x)" refers to the number of shape and size classes indicated by each term; * denotes size classes, only)

xingzhuang (shape class)	Hougang	Baiying	Meishan	Lujiakou
bei	new (3)	new (5)	new (6)	new (4)
bi	new (2)	old (1)	old (1)	old (1)
bo	new (1)	old (1)	--	old (1)
bu	old (1)	--	--	--
ding	old (1)	new (2)	old (1)	new (7)
dou	old (2)	old (1)	old (1)	old (1)
gai	old (5)	new (11)	old (2)	old (4)
gang	new (2)	--	--	--
gu	--	--	old (1)	--
guan	new (3*)	new (10)	old (1)	new (9)
gui	old (1)	old (1)	old (1)	old (1)
he	--	--	old (1)	--
hu	old (1)	--	--	old (1)
jia	old (2)	new (3)	old (1)	--
lei	--	--	--	old (1)
lei-bo	--	old (1)	new (2)	--
li	old (1)	old (1)	--	--

pan	--	old (1)	--	--
panxingqi	--	old (1)	--	--
pen	new (2)	--	--	new (10)
ping	old (1)	--	--	--
pingdipen	new (2*)	new (3)	--	--
quanzupan	new (2)	old (1)	old (2)	--
sanzupan	--	--	--	old (4)
shenfupen	old (1)	--	--	--
shuangfupen	--	old (1)	--	--
sizumin	old (1)	--	--	--
wan	new (5)	new (4)	new (6)	new (2)
weng	old (1)	old (1)	old (1)	--
xian/yan	new (1)	old (1)	old (1)	old (1)
yu	--	--	--	new (2)
zeng	old (1)	old (1)	old (1)	--
zhe (qu) fupen	old (1)	new (3)	new (1)	--
zun	--	old (1)	--	--
zuo	old (1)	old (1)	--	--
other jars, no necks	--	--	old (3)	--
other necked jars	--	--	old (3)	--
other pitchers	--	new (4)	--	--

Longshan sites are given in Table 16. The table describes common varieties or subclasses of xingzhuang (illustrated in Figure 4).

Some terms usually refer to a wider range of forms than others, such as bei cup, gai lid, guan jar, pingdipen basin, pen container, and wan bowl. In other words, these terms often refer to a variety of proportions, requiring subdivision into different shape classes. One factor contributing to this conclusion is that relatively large samples of vessels were available to evaluate these classes. If other classes were represented by larger samples, a similarly wide range of variation might be apparent. Cultural factors are probably important as well. These forms are more common on sites than other forms, reflecting relatively high rates of production, use, and discard. The morphological variation may also represent a relatively large number of separate producing units. This possibility is discussed in Chapter 6. Many terms incorporate more than one size of vessel, too. Different size classes of vessels are common in traditional societies and often indicate different functions.

This pattern of subsuming more than one shape under a given traditional term characterizes reports of other late prehistoric sites. Li Chi et al. (1956) state that the Chengziya site in Shandong contains several varieties of dou stemmed dish, ding tripod, bei cup, guan jar, gai lid, pen container, and wan bowl. Keightley (1985a) describes how the terms dou stemmed dish, xian tripod, and ding tripod refer to more than one shape of vessel from the earlier phases at the Dahe site.

Table 16. Proposed Definitions for Major Shape Classes of Vessels (Xingzhuang) in Longshan Sites.

bei	a class of vessels with great variation in shape; forms are similar to modern cups, most form are tube-shaped, with rim diameter/base diameter ratio close to 1.0; handles optional
bi	a class of vessels with straight walls, relatively wide rim diameter and base diameter, and small circular holes pierced through the base; again there are variants in terms of vessel size, and size and shape of holes. Two other forms are in sites: 1) a vessel with straight walls, relatively wide rim diameter and base diameter, and saw-tooth shaped ridges completely around the base, and 2) a small bowl with holes pierced through the lower body and base
bo	a small bowl with a bulge (usually a point of maximum body diameter) at the middle or lower portion of the body that may be rounded or sharp in profile (a carination point), the rim tends to be wide in comparison to the base
bu	a short, relatively wide vessel in terms of maximum diameter, bulbous in shape, with a flaring rim
ding	a globular vessel with a moderately wide orifice, flaring rim, round base, and 3 solid feet of various shapes and sizes; there is variation in degree of globularity (maximum diameter/height)
dou	a stemmed dish; there is variation in depth and size of dish, and in height and width of stem

gai — a lid, a variety of shapes and sizes; including flat lids, shallow-bodied lids, and lids with deep bodies that are bowl-like in shape; a variety of shapes of handles (one or two per vessel)

gang — a large jar, overall the major class of vessels with the largest vessels in terms of height and maximum diameter, a relative small base and wide orifice, handles optional; two varieties: 1) short, wide neck and 2) no neck

gu — a vessel shaped like a modern beaker with a tall body, splayed foot and distinctly wide, flaring rim

guan — a jar with a flat base, ill-defined shoulder, flaring rim, partially constricted orifice, the point of maximum diameter is at the mid-body, no handles; more than one size class; reports apply this term to other shapes of jars as well, some with necks

gui — a relatively large legged vessel with a large, wide spout, a large handle (more than one variety); three legs that are either relatively thin and solid, or wide and hollow (mammiform)

he — a short, wide vessel with a relatively small base and wide orifice, incurving rim, point of maximum diameter is at the shoulder

hu — a jar with a long, wide neck and small flaring rim, the orifice diameter is slightly smaller than the neck diameter, the point of maximum body diameter is approximately mid-height and the change in profile is abrupt, handles optional _jia_ — a tripod with relatively wide hollow legs, vessel body is relatively globular, wide orifice and flaring rim; there are variations in height of rim, shape of body (in terms of maximum diameter/ height), and shape of base (relatively flat or round)

lei — a jar with a relatively tall, narrow neck; relatively small pedestal-like base, the point of maximum diameter is at the shoulder and is carinated in profile; four wide, flat handles

lei-bo — a bowl with small base, wide orifice and incurving rim, the point of maximum diameter is at the orifice, there are large, wide engraved lines that radiate out from the interior base up the sides, covering the entire inside portion of the vessel; another, less common variety is a tall and narrow vessel, cup-shaped

_li_ — a large, globular tripod vessel with short neck and wide flaring rim, the hollow legs are wide and tall, bag-shaped or mammiform, and the legs are tall in relation to the body

pen — a jar that is relatively short and squat in shape, with a wide orifice, wide flaring rim, and small base; there are two varieties, those with a distinct shoulder, and those without like _shenfupen_

ping — a small jar with a short, wide neck, globular body and relatively wide base, small rim

pingdipen — like other _pen_, this vessel has a relatively wide rim diameter and orifice diameter; however there is a wide base and the vessel is relatively shallow (low in height); there is more than one variety in terms of orifice diameter, base diameter, and height

quanzupan	a large, relatively shallow dish on a wide stem or ring foot; shape of dish varies -- some are very shallow, or plate-like
sanzupan	a relatively wide and shallow vessel with outflaring walls on three short legs, legs may be hoop-shaped or solid
shenfupen	a relatively tall jar with a small base, large orifice and wide flaring rim; no distinct shoulder, the point of maximum diameter is the rim rather than an area of the body, handles optional
sizumin	the body of this vessel is essentially a basin or _pingdipen_, there are 4 short and wide feet
wan	a vessel with short, outflaring walls and a relatively small base, the rim is the point of maximum diameter; there is more than one variety in terms of rim diameter, base diameter, and height; and more than one size class
weng	a large jar with a relatively narrow and distinct neck, distinct shoulder that is the point of maximum diameter, small base, small flaring rim, more than one size class; handles optional
xian/_yan_)	a tall tripod vessel with hollow or bag-shaped legs; two distinct portions: bottom portion or the legs, and the upper portion that is shaped like a _guan_ jar; these vessel parts are connected; the space between these two parts may have had a small _bi_ grate
_yu_	a small vessel the size of a cup that is relatively short and squat, there is a bulge at the lower portion of the body approximately equal in size to the rim diameter, relatively wide base and small flaring rim

zeng — a jar with a wide orifice and wide, flaring rim; ill-defined shoulder, overall shape is relatively short and squat; there are several holes pierced through the base; some vessels have holes pierced through the lower body as well

zhefupen — like other *pen*, this vessel has a relatively wide rim and orifice diameter, and small base diameter; there is a sharp carination point at the lower portion of the vessel, overall shape is short and wide

zun — a small vessel the size of a cup with a distinctly wide, flaring rim, wide orifice, and bulge at mid-height, and a wide base

zuo — a large vessel with distinctly wide bottom and flaring walls, there is variation in overall shape (maximum diameter/height) -- some vessels are short and squat, others are more tall and narrow; no base

Figure 4. Major forms of vessels in Longshan sites.
(not to scale)

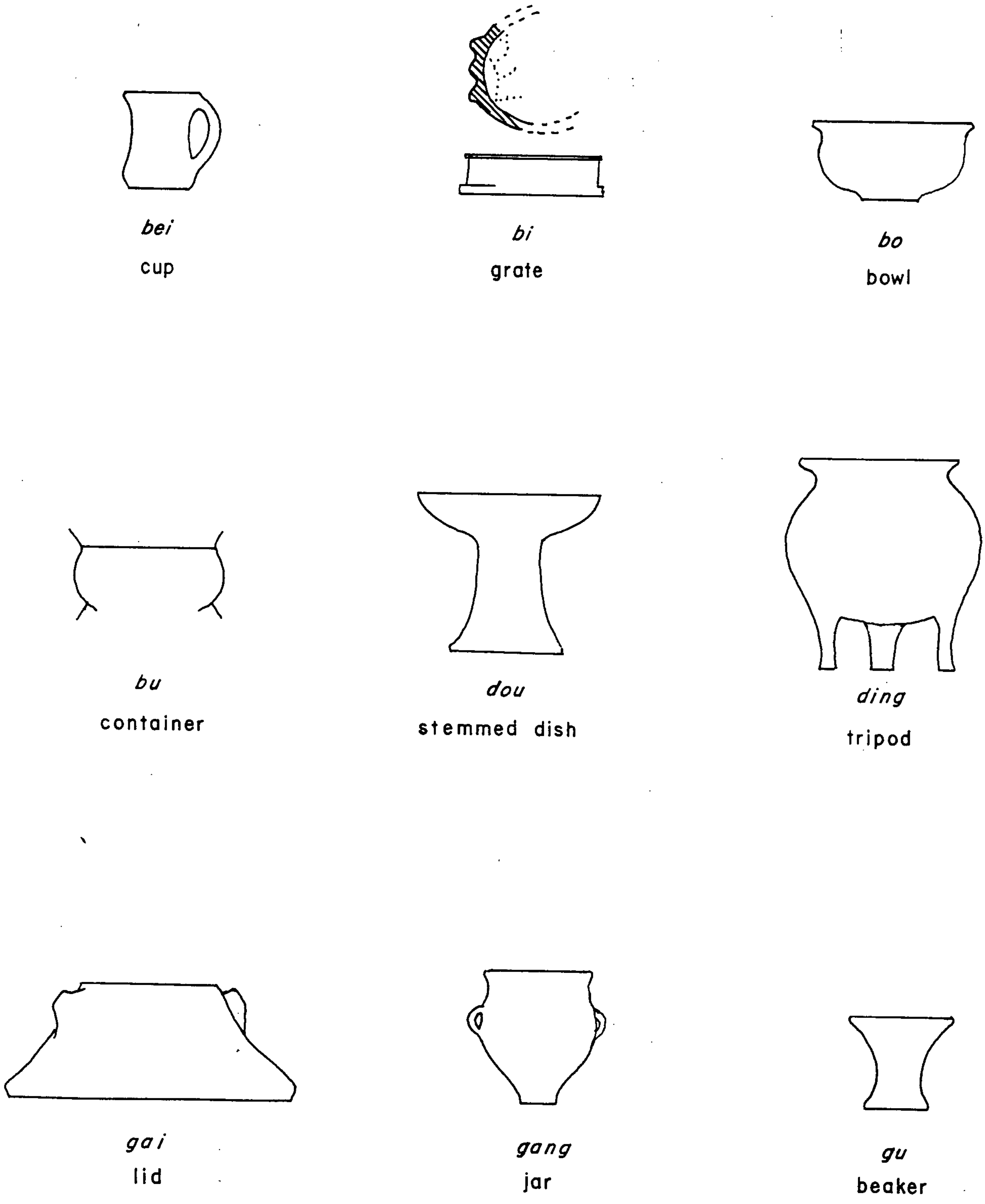
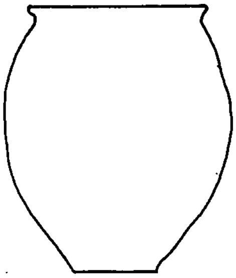
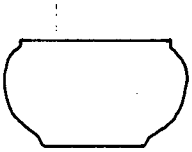


Figure 4 continued...

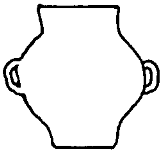


guan
jar

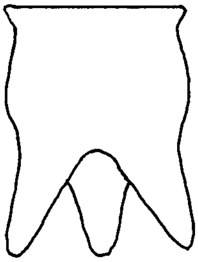
gui
pitcher



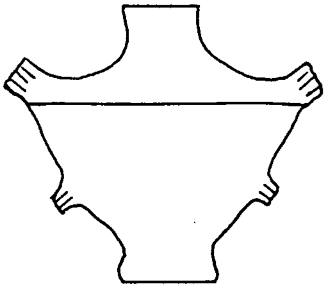
he
"box"



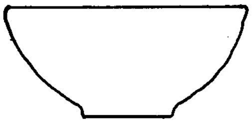
hu
necked jar



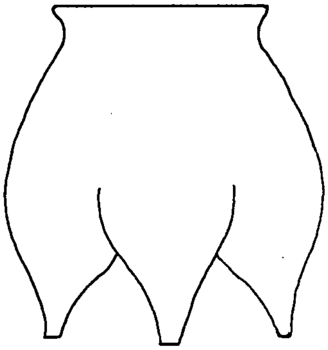
jia
tripod



lei
jar



lei-bo
bowl

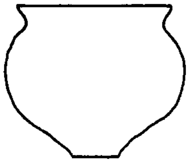


li
tripod

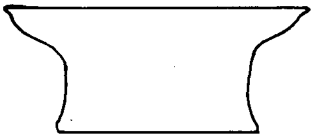
ping
necked jar

Figure 4 continued...

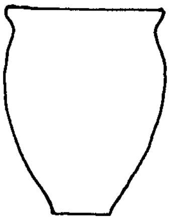
pingdipen
flat-bottomed basin



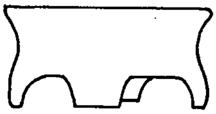
pen
jar



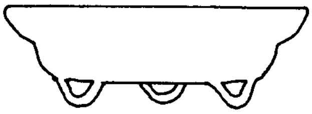
quanzupan
ring foot dish



shenfupen
deep belly jar

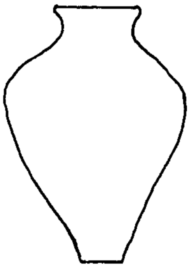


sizumin
four-footed vessel

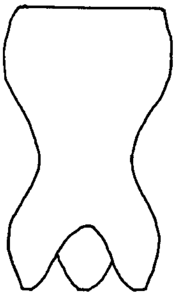


sanzupan
three-footed dish

wan
bowl

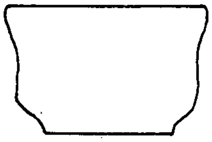


weng
necked jar

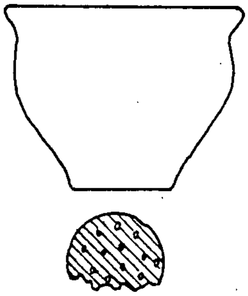


xian (yan)
tripod composite steamer

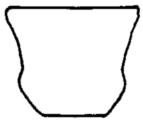
Figure 4 continued...



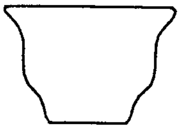
yu
container



zeng
steamer



zhefupen
"bent belly" vessel



zun
container

zuo
stand

In terms of methodology, the analyses indicate the utility of comparing visual observations with results from statistical analyses. Statistical techniques are useful for supporting overall patterns observed by eye. Analyses may indicate that more than one grouping is possible, and results should match visual observations. On the other hand, statistical analyses can demonstrate that what appear to be separate groups instead represent the range of variation for one group.

For sake of convenience, I describe specific results for sites in the following order: jars, open forms, legged vessels, cups, and lids. At every site there is a wide variety of jar forms without necks. At Hougang, there are three clear size classes of guan jars: small (xiao guan, N=5), medium (guan, N=18), and large (shenfu guan, N=15). These classes, defined in the report, are identifiable by a scatterplot of height with maximum diameter (Appendix A, Figure 5). My results agree with the original classification with the exception of one pot. A Kruskal-Wallis test indicates that the three size classes are significantly different in terms of height ($p=0.000$). Sample size is inadequate to identify size classes of guan or other jars from the other sites.

The Hougang report identifies subtypes of medium and large guan jars. I use seven ratios that quantitatively express the criteria it cites as important in forming groups. Nonparametric tests indicate that none of the subtypes are significantly different from one another.

The Baiying, Meishan, and Lujiakou reports use the term "guan" to refer to a variety of shapes of jars, with or without necks. The Baiying and Meishan reports do not use several terms for jars that are in the Hougang report such as pen, ping, or hu. Sample size is sufficient to examine variation in size of guan jars, class eight (N=11), at Baiying by a scatterplot (Appendix A, Figure 6). One pot is distinctly larger than the others, but other size classes are not clear. In the Lujiakou report, the term "pen" is used to refer to a wide range of shapes, including open forms and jars.

Sample size is sufficient to examine three types of open forms at sites: pingdipen basin, wan bowl, and quanzupan pedestalled dish. Four ratios are thought to express the criteria used in the Hougang report to identify two subtypes of pingdipen basin (N=24). A Mann-Whitney test using "known" vessels indicates no significant difference between the two groups. Several "unknown" basins may be added to the sample in order to make a scatterplot with two ratios, orifice diameter/height and orifice diameter/base diameter (Appendix A, Figure 7). For classification on the basis of vessel proportions for this type of shape, ratios with orifice diameter are preferable to those with rim diameter, since rim form tends to have stylistic rather than formal-functional significance (Henrickson and McDonald 1983:635). The scatterplot indicates no distinct clustering of vessels to justify division into subclasses. Another scatterplot, of rim diameter with height, shows that there are clearly two sizes of basins at Hougang: one pot is distinctly larger than the rest (Appendix A, Figure 8).

A similar scatterplot for the pingdipen basins at Baiying (N=7) seems to identify two clusters of vessels (Appendix A, Figure 9). However, a Mann-Whitney test indicates no significant difference between groups. It also shows that one vessel is distinctly different in terms of orifice diamter/height. This is a function of size of orifice, as a separate scatterplot for differences among vessels in terms of size indicates (Appendix A, Figure 10).

It is also possible to examine morphological variation in wan bowls from Hougang, Meishan, and Lujiakou. Two ratios are thought to express criteria for identifying subtypes of bowls (A, B, C) at Hougang: rim diameter/base diameter and rim diameter/height. A Kruskal-Wallis test indicates that the three subtypes for 23 "known" pots are significantly different from one another in terms of rim diameter/base diameter (p=0.003). When 21 "unknown" bowls are added to the sample (giving a total of N=44), and another scatterplot generated, it can be seen that variation is primarily in terms of this same ratio. However, the scatterplot shows no distinct subgroups of bowls (Appendix A, Figure 11). Also, I found that significant results with nonparametric tests could be achieved by assigning pots to more than one set of shape classes from the scatterplot. Therefore I see no justification for dividing the bowls into subclasses. A separate scatterplot of rim diameter with height shows that there is a wide range of sizes of bowls at Hougang (Appendix A, Figure 12).

Bowls at Meishan and at Lujiakou may be evaluated by the same ratios. The scatterplot for Meishan (N=11) shows no clear clustering of vessels (Appendix A, Figure 13). Again, there is a wide range of variation in terms of size, but no distinct breaks in the plot (Appendix A, Figure 14). A scatterplot combining five "known" and 13 "unknown" bowls from Lujiakou shows one pot as clearly separated from the others. It is assigned to a different class, since it is qualitatively different. There is a wide range of sizes of bowls at this site as well (Appendix A, Figures 15, 16).

Two subtypes of quanzupan pedestalled dish (N=7) defined in the Hougang report may be evaluated by examining variation in one ratio, rim diameter/height of dish (RD/BHT). A Mann-Whitney test indicates no significant difference in the two subtypes. However, my observations of these vessels and illustrations in the report indicate that two different subclasses should be defined in terms of this ratio. There is a clear break in the range of values for the ratio to justify establishment of two classes: 1) shallow or plate-like dish (N=2), and 2) relatively deep dish (N=5).

The Lujiakou report identifies three subtypes (A, B, C) of ding tripods. These are evaluated using two ratios thought to express the criteria stated in the report: orifice diameter/maximum diameter and maximum diameter/height of orifice diameter. The scatterplot (N=7) shows that the groups identified in the report are not distinctly different from one another (Appendix A, Figure 17). There is no justification for establishing other subgroups.

A scatterplot of six bei cups at Baiying with rim diameter/height and rim diameter/base diameter shows that one pot is separated from the others (Appendix A, Figure 18). Again, it is not ideal to define a separate shape class on the basis of only one vessel. However, illustrations in the report indicate that the cup is qualitatively different from the others in terms of shape. Finally, a scatterplot (Appendix A, Figure 19) shows that one gai lid at Baiying is clearly larger in size than the others (N=16, two with inadequate data for the plot).

HYPOTHESES ABOUT VESSEL FUNCTION

This section describes archaeological evidence for vessel function at Hougang, Baiying, Meishan, and Lujiakou, and at other Longshan Period sites. There is limited information on type of paste, residues from use, context of deposition, ethnographic analogy, and shape from Longshan sites -- criteria that are commonly used in the West to identify vessel function (Rice 1987). It appears that five general functional types of vessels are present in sites: 1) cooking, 2) serving and eating food, 3) preparing, holding, and drinking alchoholic beverages, 4) storage, and 5) ritual. The conclusions reached in this discussion are hypotheses that require testing with adequate samples of vessels from individual assemblages.

On the basis of historical analogy, the following major shape classes of vessels should have cooking as a primary function (see Table 11): _ding_ tripod, _li_ tripod, _xian_ tripod, _zeng_ perforated jar, and _bi_ grate. On the basis of archaeological data, three other forms were probably used for cooking as well during the Longshan Period: _guan_ jar, _gui_ tripod, and _jia_ tripod. Therefore the traditional functional interpretations for these three forms may not be totally accurate: _guan_ as a storage jar, _gui_ as a serving pitcher, and _jia_ as a vessel for holding wine.

Type of paste is regarded by archaeologists in China as the most important criterion for identifying cooking vessels (Yan, personal communication, 1987b). Vessels used for cooking should have a relatively coarse paste (_jia sha_), rather than a fine paste (_ni zhi_, meaning no or small inclusions visible). Presence of soot is not always a reliable indicator, since soot may not survive postdepositional processes (ibid). Archaeologists have associated cooking vessels with coarse paste for over 30 years; An Zhimin (1953:69) remarks that coarse texture of paste helps prevent cooking vessels from cracking when heated (i.e., it helps prevent thermal shock). Zhou et al. (1982:269) mention that laboratory analysis (apparently from thin sections) of sherds in Neolithic sites indicates that cooking vessels have paste with grit inclusions. Few other classes of vessels have this type of paste.

Ethnographic data support this interpretation; among the Wa minority group, coarser paste is used for cooking vessels (Li Yangsong 1959:250).

In the Hougang, Baiying, Meishan, and Lujiakou site reports, the shape classes listed above tend to have coarse paste. In the _guan_ jar and _ding_ tripod classes, vessels may have coarse or fine paste. Small jars tend to have fine paste. Pots in six classes of _guan_ jars at Lujiakou have fine paste. Pots in one class of _ding_ at Baiying and six classes at Lujiakou have fine paste. It is likely that cooking was not the primary function of these vessels. _Ding_ tripods of very fine paste have been found at the Liangchengzhen site as well (Wu 1938:68).

My brief observations of vessels suggest that the terms "_jia sha_" and "_ni zhi_" incorporate a great deal of variability. Examination of existing fractures on vessels from Hougang with a hand lens (16x) revealed a range of types of materials, grain sizes, and density of grains. Similarly, Wu (1938:63-4) reports that there is a wide range of paste texture at Chengziyai, from very gritty to extremely fine. A systematic examination of paste composition for different shape classes could provide valuable information on ceramic function as well as diversity of raw materials exploited. Some microscopic analysis of paste texture for Neolithic ceramics has been reported. Zhou et al. (1982:269) find a range of materials represented, including feldspar and quartz. I saw two _guan_ jars from Hougang with large mica fragments. There is variation for _wan_ bowls at Hougang as well. I saw one bowl with large inclusions, and another with large voids on the surface thay may represent organic temper.

Soot has been found on the legs of gui tripods and on guan jars from Longshan sites (Yan, personal communication, 1987b). In particular, there is soot on large guan jars at Hougang and on medium-sized guan jars at the Kexingzhuang site in Shaanxi (Zhang and Zhang 1986:47,49). I noted soot on 4 medium-sized guan jars and on 1 large jar at Hougang, as well as one medium-sized guan jar at Baiying. A layer of red burnt earth has been found on some large guan jars from sites belonging to the Wangyoufang cultural branch in eastern Henan (Zhang and Zhang 1986:47). This type of residue seems to be another indication that guan jars were used for cooking during the Longshan Period.

At the Kexingzhuang site in Shaanxi, 3 guan jars and one li tripod were found inside a house near a hearth. A guan jar at the Donghaiyu site in Shandong was found in a similar location (Institute of Archaeology, CASS 1984:83,103). It is not known whether the vessels were deposited through the process of discard after use or at the time of site abandonment. The location of discard is often a poor indicator of vessel function (Rice 1987:232-3). In either case, there are additional grounds for inferring function of guan jars, i.e., coarse paste and presence of soot.

There is some evidence that guan jars had other functions during the Longshan Period as well. One is transporting and/or holding water.

At the Jiangou site in Hebei, several _guan_ jars were found at the bottom of a well (Institute of Archaeology, CASS 1984:84). They may have been dropped accidentally during use. Ethnographic analogy provides support for this hypothesis: the Dai people of southern China use _guan_ jars for water (Zhang Ji 1959:490).

Guan jars and other probable cooking vessels also served as burial urns for children. These vessels are common in Neolithic sites from the middle reaches of the Huanghe or Yellow River valley (Xu 1989). _Ding_ tripods and _xian_ tripods were used in addition to _guan_ during the Longshan Period. These vessels were used for domestic purposes before serving as burial urns; some vessels have soot on them (Xu 1989:334). My observations on burial urns from Hougang agree with these conclusions.

There is direct evidence for cooking with a vessel at one Longshan site. A _guan_ jar at Baiying contains animal bones (Sui 1988:51). Another type of residue that may be indicative of cooking is water deposits inside vessels. One _gui_ pitcher at Baiying has this type of deposit (CPAM of Anyang District, Henan Province 1983:17) and more than one at Lujiakou (Shandong Archaeological Team, IA, CASS, and the Art Museum of Weifang County, Shandong Province 1985). The _gui_ at Lujiakou are solid-legged and relatively tall. Other sites in Shandong contain a second shape of _gui_, relatively wide and with mammiform hollow legs (see Medley 1976:27). Pots of this shape may not have been used for cooking.

Several forms of cooking vessels for preparing different types of foods should be expected (Rice 1987:237). For example, see ethnographic data described by Smith (1985:304) and Miller (1985:58). Therefore several forms from Longshan sites were probably used for cooking a variety of foods. Unfortunately there is a lack of data on subsistence from the Longshan Period, as discussed in Chapter 2.

Cooking jars like guan with a flared rim are common in other areas of the world. The flared rims were probably designed with a functional purpose in mind: for lifting pots from the fire (Woods 1985:168).

It is possible that some bi grates did not function as steaming racks, as commonly assumed. More than one shape and size has been found in Longshan sites. Both forms of bi at Hougang would not have been very suitable for placement inside another vessel such as a tripod steamer. For example, class two is large with saw-tooth applique around the edge. In contrast, the bi grate from Baiying is a small bowl-shaped pot with a perforated bottom.

The lei-bo grooved container may have been used for a specific type of food preparation. According to An Jinyuan (1986:345), these vessels were probably used for grinding tuberous plants for food or medicinal purposes. Also, people in Hunan province continue to use these vessels. There is more than one form of lei-bo during the Longshan Period; some are similar to pen, bo, and guan (An Jinyuan 1986, Ye 1989).

According to the traditional definition, _dou_ stemmed dishes were used for serving food. This hypothesis is plausible, as open vessel forms tend to be used for serving and eating food, since vessel contents would be easily accessible (Rice 1987:240; Henrickson and McDonald 1983:632; Howard 1981:9). Similarly, it is commonly assumed that _wan_ bowls were used for eating and drinking at meals. This interpretation is feasible given the open form. The previous analyses show that more than one size of bowl is present in Longshan sites, probably indicative of more than one function. Different size classes of serving and eating vessels may also relate to size of the consuming group (Rice 1987:240). Small jars could have been used for drinking, too. For example, the Dai of southern China drink water from small _hu_ jars (Zhang Ji 1959:490).

Other forms of vessels at Longshan sites could have been used for serving food. Food could have been served directly from cooking vessels, especially the tripods. These legged vessels could have been placed easily on most surfaces. Other relatively open forms that are suitable for serving include _bo_ bowl, _bu_ container, _quanzupan_ pedestalled dish, and _pingdipen_ flat bottomed basin. Of course, these forms and others probably had more than one function. They could have held a variety of substances, including water.

I suggest that several forms of _gai_ lids at sites were probably used for serving food. Many of these vessels are too large (in terms of rim diameter and height) and too heavy to cover the openings of other vessels such as cooking pots (see Appendix A, Tables 45-48). Only two forms would have been suitable for covering other pots: 1) small, flat lid and 2) small, wan bowl-shaped lid. Also, some forms are small enough to feasibly cover the orifice of other vessels, but are elaborate in shape, indicating that they could have been used for serving as well.

A number of forms could have been used for holding and/or transporting water, as in rural India (see Miller 1985:61) or Guatemala (Lischka 1978). For example, necked jars such as ping would have been suitable for liquids in general.

Three forms from late Neolithic sites are commonly assumed to represent vessels for holding or serving alchohol: jia tripod (previously discussed), zun container, and hu jar. There has been little effort among western archaeologists to identify vessels used for preparing or serving alchohol, or other archaeological evidence for these activities. A recent exception is Moore (1989). This topic has received attention in the Chinese archaeological and ethnographic literature.

Two writers debate the origins of making alchohol in the Neolithic period. Fang (1964) argues that several forms recorded as used for alchohol during the historic period first appear in Longshan sites, including zun, lei, and tall stemmed cups, and therefore, represent the onset of alchohol consumption. Li Yangsong (1962) points out that alchohol production probably began at an earlier date during the Neolithic Period. People could have made alchoholic drinks from more than one grain.

More than one form of vessel may have been used for preparing, holding, and drinking alchohol. Any relatively large cooking vessel could have been used for brewing and fermenting. In the New World, beer is brewed in cooking jars in traditional societies (Bankes 1985:272; DeBoer 1974:336). Storage jars can be used for brewing (Arnold 1985:150). However, vessels for storing alchohol (on a long or short term basis) tend to have narrow openings (Arnold 1985:150, Chavez 1985:163). Small orifice diameters or neck diameters should be expected, to prevent the fermented liquids from going flat. Therefore the necked jars from Longshan sites would have been suitable for storing alchohol: weng, ping, hu, and lei. Weng jars have the narrowest necks.

Straining the cooked grain before fermentation could have been accomplished by means of a cloth (Chavez 1985:165) or a strainer made of wood or pottery with small holes. It seems that the holes in bi grates are too large for this purpose. Strainers for making alchohol may yet be found in Longshan sites. According to Wang (1986:268-9), a huge zun container from the earlier Neolithic (Dawenkou Culture) site of Lingyanghe in Shandong has a picture of a large strainer for making alchohol. Wang expects that weng jars were used for holding alchohol during the Dawenkou cultural period.

Alchohol may be drunk from vessels used for daily meals or vessels used solely for alchohol. For example, among the Shipibo-Conibo, beer mugs of a distinct shape are used (DeBoer 1974:336). In the Philippines, both types of drinking vessels are used (Solheim 1965:258).

Therefore it is not possible to conclude with certainty whether a given form of cup was used for drinking alchohol. One indication may be unusually small capacity, rendering it more feasible to drink alchohol than other liquids. Li Jianmin (1984:66) proposes that cups that could only hold a small amount of liquid were used for drinking alchohol during the Dawenkou Period in Shandong. Any cup (or bowl) from Longshan sites could have been used for drinking alchohol: bei or gu, as well as small vessels of other forms such as jars.

Vessels used for ritual purposes are perhaps the most difficult to identify, especially when primarily morphological data are available. Simple forms used on a daily basis such as a plate, bowl, or water container can be used in a ritual context as well, as in present day Kathmandu and Mexico (Birmingham 1975:372; Lischka 1978:230). However, an unusual form may signify a ritual function. David and Hennig (1972:8) describe a bowl with a unique shape used by the Fulani for ceremonial ablutions. Arnold (1985:159) describes more than one unusual form used in rituals. Two unusual forms of vessels in Longshan sites, quanzupan pedestalled dish and zuo stand, may have been used for ritual purposes.

CONCLUSIONS

The analyses described in this chapter suggest that the traditional terms used for designating shape classes should be regarded as generic and as starting pointing points for morphological classification. Some authors use a term to describe one specific form. Others use subclasses such as "A" and "B" to designate specific forms. In reports, there are a variety of formats for describing ceramic data, too. Most reports describe data that are particularly important for establishment of culture history. Archaeological data on function support some assumptions from the traditional terms and do not support others. A priority in future research should be to systematically investigate ceramic function at individual sites, utilizing more than one line of archaeological evidence.

CHAPTER 5. TEST OF THE MODEL

INTRODUCTION

This chapter describes the test of the model of change in production of pottery in relation to increasing cultural complexity, based on the model by Rice (1981). In the ceramic analyses I use shape classes from Hougang, Baiying, Meishan, and Lujiakou that were defined in Chapter 4. The first part of this chapter is a description of the test of change in strategy of producers, i.e., simplification, diversification, or conservatism. There are three analyses: 1) diversity of shape classes by phase, 2) dimensional standardization, and 3) within-class standardization in terms of secondary shape features and techniques of decoration. In addition, proposed evidence for relative lack of labor input in production (shaping and decorating) is discussed. The second part describes the test of change in labor-intensive prestige vessels that could have been used in displays of status at inter-household social events. The model proposes that changes in consumer demand for these vessels has an impact on production. Vessels are identified that exhibit a relatively high degree of labor input: having large size, elaborate form, thin walls and/or polishing.

In brief, the analyses suggest that the patterns of change in ceramic production at Baiying and Lujiakou differ from the patterns for

Hougang and Meishan. There is more evidence for diversification in production at the former two sites. However, there are some similarities between Hougang and Baiying with respect to diversification of labor-intensive wares. In contrast to the other three sites, a pattern of conservatism resulted from most analyses for the westernmost site of Meishan. For each site, more than one strategy of production is evident.

The model of change in production in relation to increasing cultural complexity is partially supported. Sample sizes for each analysis are small, and results should be regarded as hypotheses that require more adequate testing in the future. There is some evidence for diversification in production over time at three of the four sites, with respect to variety of shape classes produced (two sites) and labor-intensive prestige wares. Although information on labor-intensive wares is especially limited, the available data (for Hougang, Baiying, and Lujiakou) appear to support the hypothesis by Rice (1981) that there should be increasing varieties of prestige wares. However, data on dimensional standardization and within-class standardization do not support her hypothesis that there should be increasing standardization of wares as cultural complexity increases.

ANALYSIS OF CHANGE IN PRODUCTION: STRATEGIES OF PRODUCERS

Diversity of Shape Classes

An increase in diversity of shape classes over time at sites represents the process of diversification, whereby potters respond to consumer demand for an increasing variety of wares. A decrease in diversity of shape classes over time represents simplification. Reducing the variety of wares is one method to increase efficiency in production. A sharp decline in variety of shape classes made over time could signify a factor causing stress on a cultural system such as increased warfare, famine, or environmental degradation. Lack of change in quantity of shape classes produced over time indicates conservatism, or resistance to change.

The comparison of change in quantity of shape classes in each period results in a clear pattern of diversification over time for Lujiakou. The pattern for Meishan is conservatism. For Hougang, there is evidence for simplification from one phase to another. For Baiying, there is diversification from the Early to Middle Period and conservatism from the Middle to Late Period. For a complete list of forms per phase at each site see Appendix B (Tables 49-52). For each site, the total number of shape classes per phase is divided by the number of excavated houses per phase (Table 17). This is a rough method

Table 17. Comparison of Total Number of Shape Classes Made During Each Phase at Hougang, Baiying, Meishan, and Lujiakou.

Hougang	Baiying	Meishan	Lujiakou
Early 31/2 houses =15.50 forms per house	Early 15/9 houses = 1.67 forms per house	Early 27/17 houses = 1.59 forms per house	Early 20/6 houses = 3.33 forms per house
Middle 32/14 houses = 2.29 forms per house	Middle 22/8 houses = 2.75 forms per house		
Late 30/23 houses = 1.30 forms per house	Late 40/46 houses = 0.87 forms per house	Late 26/16 houses = 1.63 forms per house	Late 47/5 houses = 9.40 forms per house

note: dividing the total number of shape classes by number of excavated houses provides a rough method of standardizing values according to the total area excavated per period of standardizing values for quantity of shape classes by volume of earth excavated for each phase, since the relevant information is not provided in the site reports.

From the data in Table 17, it appears that there is marked simplification from the Early (transitional to the Longshan Period) to the Middle Period at Hougang. However, a scatterplot depicting quantity of houses per phase by quantity of forms per phase would indicate a modest degree of simplification over time (R.G. Matson, personal communication, 1990). This method illustrates how sample size affects diversity (ibid).

There is further support for the pattern of modest simplification from the Early to Middle Period at Hougang in that the analyses of dimensional standardization, within-class standardization, and labor input do not result in a pattern of marked simplification. The pattern of modest simplification for the Middle to Late Period transition at Hougang indicated in Table 17 would be evident on a scatterplot. For Baiying, both Table 17 and a scatterplot would indicate a pattern of modest diversification from the Early to Middle Period. Although Table 17 suggests a pattern of simplification from the Middle to Late Period at Baiying, a scatterplot would indicate a pattern of conservatism (ibid). Comparing quantity of forms at Baiying is difficult given the great difference in sample size from the Middle to Late Period. Scatterplots would indicate the patterns evident in Table 17 for Lujiakou and Meishan.

Comparison of diversity in number of forms per functional class over time is not as straightforward (Table 18; for details on specific shape classes at each site see Appendix B, Tables 53-56). For example, it is not clear whether there is a decline over time in quantity of shape classes made in every hypothesized functional category at Hougang, or whether only a few functional categories are involved. Similarly, it is not known whether there is indeed an increase in forms of cups produced over time at Hougang and at Baiying, or open forms at Baiying.

On the basis of data regarding quantity of houses excavated from each phase, relatively small areas were dug for the early periods at Hougang and Baiying. Reports do not specify the volume of earth excavated per period. Dividing the figures in Table 18 by quantity of houses per phase as an estimate for volume of excavated earth results in figures with values less than 1.0. Although this method of comparison is certainly not ideal, the figures suggest that for every inferred functional category at Hougang and Baiying, quantity of shape classes does not decline over time. From ca. 2500-2200 B.C. (Middle to Late Period at Hougang, Early to Middle at Baiying), there may be an increase rather than decrease in diversity of a few forms. For example, there may be an increase in types of bowls at Hougang and bowls, cups, lids for serving food, and small pitchers at Baiying.

Since the quantity of houses excavated at Meishan and at Lujiakou per phase is approximately the same, the figures in Table 18 constitute an accurate basis for comparison. One change at Meishan is relatively

Table 18. Change Over Time in Quantity of Shape Classes By Hypothesized Functional Category at Hougang, Baiying, Meishan, and Lujiakou.

note: values in parentheses are derived from division by number of houses per phase, as a rough method of standardizing by amount of earth excavated per phase. An approximately equal number of houses per phase was excavated at Meishan and Lujiakou. "E"= Early, "M"= Middle, "L"= Late

hypothesized functional category	Hougang	Baiying	Meishan	Lujiakou
cooking tripods	E 6 (3.0)	E 4 (0.44)	E 3	E 2
	M 5 (0.36)	M 3 (0.38)		
	L 6 (0.26)	L 6 (0.13)	L 3	L 3
other cooking pots	E 4 (2.0)	E 0 (0)	E 3	E 1
	M 4 (0.29)	M 1 (0.13)		
	L 2 (0.09)	L 3 (0.07)	L 3	L 2
other jars with wide orifice for storage, long or short term	E 4 (2.0)	E 0 (0)	E 2	E 1
	M 6 (0.43)	M 4 (0.50)		
	L 4 (0.17)	L 4 (0.09)	L 1	L 2

jars, narrow orifice, for liquids	E 2 (1.0)	E 1 (0.11)	E 2	E 4
	M 3 (0.21)	M 1 (0.13)		
	L 3 (0.13)	L 3 (0.07)	L 3	L 6
bowls, for eating, drinking, serving	E 4 (2.00)	E 1 (0.11)	E 5	E 1
	M 1 (0.07)	M 2 (0.25)		
	L 5 (0.22)	L 2 (0.04)	L 5	L 4
other open forms, no pedestal or stem; for preparing, serving food	E 2 (1.0)	E 3 (0.33)	E 4	E 4
	M 3 (0.21)	M 3 (0.38)		
	L 2 (0.09)	L 6 (0.13)	L 1	L 12
open forms with pedestal or stem for serving, eating food	E 5 (2.50)	E 0 (0)	E 3	E 5
	M 5 (0.36)	M 0 (0)		
	L 4 (0.17)	L 2 (0.04)	L 2	L 11

cups for drinking	E 0 (0)	E 1 (0.11)	E 4	E 1
	M 1 (0.07)	M 2 (0.25)		
	L 2 (0.09)	L 2 (0.11)	L 5	L 3
lids for covering other vessels	E 0 (0)	E 1 (0.11)	E 0	E 1
	M 1 (0.07)	M 1 (0.13)		
	L 0 (0)	L 1 (0.02)	L 0	L 2
lids for serving food	E 3 (1.50)	E 2 (0.22)	E 2	E 0
	M 3 (0.21)	M 3 (0.38)		
	L 2 (0.09)	L 6 (0.13)	L 2	L 2
small pitchers	E 0 (0)	E 1 (0.11)	E 0	E 0
	M 0 (0)	M 2 (0.25)		
	L 0 (0)	L 1 (0.02)	L 0	L 0

distinct, a decline in quantity of open forms with no pedestal or stem. At Lujiakou, there is a marked increase in quantity of open forms produced over time, as well as an increase in nearly every inferred functional category.

Comparisons of diversity of forms produced over time at sites must take three factors into account: percentage of site area excavated, ceramic use-life, and depositional behavior. In addition, formats for describing ceramic data in reports must be considered. For example, it is important to discuss whether some functional categories of vessels could be under-represented at sites.

One reason for the relatively large number of shape classes recovered at Baiying may be the relatively high percentage of site area excavated (Table 19, see also Table 4, Chapter 1). I suggest later that a cultural factor, i.e., social demand, may be responsible for the pattern as well. As discussed in Chapter 1, the low quantity of vessels reported at Baiying in comparison to Hougang is probably due to the fact that fewer vessels were reconstructed. There is too little information about Meishan to determine whether the relatively low number of shape classes is a result of small excavated area. The small quantity of vessels recovered from Lujiakou may be explainable by the low percentage of site area excavated.

One reason for the relatively small percentage of non-tripod cooking pots at Baiying may be that "nicer looking" vessels were a priority in reconstruction. The low number of bowls reported at Baiying

Table 19. Quantities of Forms by Hypothesized Functional Category at Hougang, Baiying, and Lujiakou.
(note: there is insufficient information for Meishan)

functional category	Hougang	Baiying	Lujiakou
cooking tripods	59 pots (13.0%)	38 pots (20.3%)	6 pots (5.0%)
other cooking pots	115 pots (25.3%)	18 pots (9.6%)	11 pots (9.2%)
other jars with wide orifice, for storage	45 pots (9.9%)	16 pots (8.6%)	5 pots (4.2%)
jars with narrow orifice, for liquid storage	35 pots (7.7%)	10 pots (5.4%)	11 pots (9.2%)
bowls, for eating, drinking, serving	84 pots (18.5%)	8 pots (4.3%)	28 pots (23.3%)
other open forms, no pedestal or stem, for preparing, serving food	34 pots (7.5%)	34 pots (18.2%)	37 pots (30.8%)
open forms with stem or pedestal, for eating, serving food	38 pots (8.4%)	9 pots (4.8%)	11 pots (9.2%)
cups for drinking	8 pots (1.2%)	14 pots (7.5%)	6 pots (5.0%)

small pitchers for serving liquids	0	5 pots (2.7%)	0
lids for covering other vessels	1 pots (0.2%)	17 pots (9.1%)	4 pots (3.3%)
lids for serving food	35 pots (7.7%)	17 pots (9.1%)	1 pot (0.8%)
other forms (zuo stand)	1 pot (0.2%)	1 pot (0.5%)	0
TOTAL NUMBER OF FORMS	44	61	49
TOTAL NUMBER OF POTS	454	188	134
percentage of site area excavated	1.81%	5.45%	0.91%

is misleading, because one form of gai lid (for covering other vessels) is equivalent to wan bowls at Hougang. The relatively low number of cooking vessels at Lujiakou is explainable by the small area excavated. Quantities of cooking pots at Hougang are probably a more accurate representation of the systematic context than quantities at the other sites. Ethnoarchaeological studies indicate that traditional societies tend to produce a relatively large number of cooking vessel forms, and in large quantities (Rice 1987:295). These vessels often break during use (Rice 1987:297-9), and they are replaced relatively quickly (Rice 1987:303).

Necked vessels that may have been used for storing and serving alchohol such as hu, weng, and lei are not common at sites. The low number of forms and vessels may not represent the frequency with which drinking events took place. In the Philippines, for example, pots for alchohol tend to have a long life-span and are replaced less often. Consumers desire old vessels that enhance the flavor of the alchohol (Solheim 1965:256). According to one member of the Kalinga, wine jars "will last forever if you are careful" (Longacre 1981:63).

The kinds and quantities of cups and pitchers produced at sites may have been higher than Table 19 indicates. These forms tend to have relatively thin walls and break easily. Also, thin-walled pots tend to break into many pieces (Rice 1987:291). These factors, combined with relatively small size, may have inhibited discovery at sites and reconstruction of certain types of vessels by archaeologists.

Prestige vessels used for social display must be under-represented at sites. Hougang, Baiying, Meishan, and Lujiakou do not represent "Pompei" type archaeological sites. Instead, they appear to represent gradual abandonment with no intention of returning, a process described by Deal (1983:210) in his ethnoarchaeological study of discard behavior. Few vessels were found in houses at these sites, as mentioned in Chapter 1 (see Table 5). The majority were found in test or open excavation areas with no cultural features. These vessels may represent dispersed or broadcast dumping, and the vessels in pits, dumping in discrete areas (see Deal 1983:198). Vessels with relatively high value would have been taken by the occupants at the time of abandonment (Deal 1983:210).

Some patterns evident in Tables 18 and 19 may be explained by cultural factors. At Baiying and Lujiakou, the two easternmost sites, there are several forms of vessels that could have been used in displays of status at inter-household events. At Baiying and at Lujiakou, there is a higher percentage of cups in relation to other forms than at Hougang (Table 19). The possible increase in diversity of shape classes at Baiying from the Early to Middle Period (Table 18) involves forms that could have been used in social displays such as cups, lids for serving food, and small pitchers. Similarly, the marked increase in quantity of open forms over time at Lujiakou may have been caused by increased social demand for display vessels. Consumers attempting to enhance their positions of status may demand greater varieties of vessels that can be used for the same function, a process that Miller (1982) observes in India.

There may be inaccuracies due to my methods of interpreting the formats of describing vessels in reports. In the Hougang report, the number of vessels excavated per phase is sometimes not clear. On the basis of patterning in style numbers for individual xingzhuang or major shape classes, at times I had no choice but to estimate the number of vessels from each shape class per phase. In the report, low style numbers tend to be associated with the Early Period, and high style numbers, with the Late. The Lujiakou report is especially unclear in this regard. However, my interpretation of an increase in variety of shape classes produced over time agrees with the conclusion reached by the Shandong Archaeological Team, IA, CASS and the Art Museum of Weifang County, Shandong Province (1985:348).

Dimensional Standardization

Sample size is sufficient to assess change in dimensional standardization with statistical techniques for a few classes at Hougang, Meishan, and Lujiakou (Table 20). At Hougang, there are three or more vessels per phase in four shape classes: large guan jars, medium-sized guan jars, medium-sized pingdipen basins, and wan bowls (class one). At Meishan, there is an adequate sample of guan jars and

Table 20. Analysis of Dimensional Standardization.

site	form	sample	dimension
Hougang	large *guan* jar	Middle, N=8 Late, N=5	OD BD MXD ODHT
	medium size *guan* jar	Early, N=3 Middle, N=7 Late, N=8	OD BD MXD ODHT
	pingdipen basin, medium-sized	Early, N=5 Middle, N=5 Late, N=13	OD BD HT
	wan bowl, class one medium-sized	Early, N=8 Middle, N=10 Late, N=12	RD BD HT
Meishan	*guan* jar	Early, N=3 Late, N=5	OD
	ding tripod	Early, N=5 Late, N=6	OD MXD
Lujiakou	*ding* tripod class seven	Early, N=3 Late, N=4	OD MXD BHT

ding tripods. There are enough ding tripods (class seven) for analysis at Lujiakou. For Hougang and Lujiakou, I use primarily measurements of vessels taken in the field. For Meishan, all measurements are from scale drawings in the report.

Since these data sets consist mainly of whole (reconstructed) vessels, it is possible to assess more than one dimension per vessel. For Meishan, however, most of the jars and tripods illustrated in the report are fragmentary. Therefore fewer dimensions could be analyzed.

The small number of vessels available for analysis precludes statistical techniques used in other studies of ceramic production such as coefficient of variation (Longacre et al. 1988, Toll 1981) and histograms with parametric significance tests (Davis and Lewis 1985, Hagstrum 1986). I use a method more suitable for small samples: inspection of boxplots depicting the range of variation (interquartile range) for individual measurements over time. The interquartile range is more appropriate than the total range for comparative purposes since it is more resistant to sample size. The boxplots were constructed by SYSTAT and SYGRAPH (Wilkinson 1988a, 1988b).

A significant reduction over time in the range of values for a given measurement would indicate an increase in dimensional standardization. This pattern would represent the process of simplification in production, or efforts to increase efficiency. Conversely, a significant increase in range of values would indicate a decrease in dimensional standardization over time, or an increase in morphological diversity for a shape class.

The analysis of each shape class assesses change in major dimensions. For jars, basins, and tripods, I use orifice diameter rather than rim diameter. On the basis of ethnoarchaeological data, size of rim can vary substantially on vessels, even those made by specialists (Rice 1988:6).

Analyses of dimensional standardization should not be conducted unless variation in size can be assessed. If different size classes are not recognized, analytical results may be inaccurate (Rice 1988:3). A recent ethnoarchaeological study indicates that in this type of situation, variation in dimensions is actually less than an analysis would show (Longacre et al. 1988:108).

For this reason, it is not appropriate to conduct analysis of dimensional standardization on wan bowls (class one, N=12) at Meishan or those at Lujiakou (class one, N=17). Scatterplots of height by rim diameter (Appendix A, Figures 14, 16) show that there is considerable variation in size of bowls at each site. Sample size is too small in each case to identify distinct size classes with confidence. The scatterplots show that there are probably three to four size classes of bowls at each site. Creation of size classes from these samples would make analysis of dimensional standardization impossible, since sample size would be too small.

However, it is possible to subdivide the sample of bowls from Hougang (N=44) and result in an adequate sample for analysis. Although the scatterplot in Appendix A (Figure 12) for these bowls does not indicate clear breaks in the distribution, the wide range of values for rim diameter indicates that size classes should be defined. On the basis of the scatterplot, a stem and leaf display of values for rim diameter, and my observations in the field, I define three size classes of bowls at Hougang: small (N=11, rim diameter less than or equal to 9.0 cm), large (N=3, rim diameter more than or equal to 18.9 cm), and medium (N=30, with intermediary values for rim diameter). Sample size is sufficient to use the medium-sized vessels in analysis of dimensional standardization.

For each shape class tested, the boxplots do not indicate a clear pattern of increasing standardization or reduction in interquartile range, for any dimension (Appendix B, Figures 20-26). Indeed, some boxplots suggest the converse, or increasing diversity in range of values. Larger samples of vessels are necessary to determine whether there is support for a pattern of diversification. A change in degree of standardization should be evident from boxplots of more than one dimension for a given shape class. The small sample of vessels analyzed here suggests that potters adopted a strategy of conservatism during the Longshan Period, since there is no evidence for a clear change in standardization over time.

A pattern of conservatism is explainable in light of the inferred functional categories of vessels examined. Sample size was sufficient to examine cooking vessels (large and medium-sized guan jars, ding tripods), basins (pingdipen) that could have been used for a wide variety of purposes such as serving or preparing food or liquids, and wan bowls for eating and drinking. On the whole, these are common shape classes at sites. They would have been among the set of vessels used most often by people. The results here support the prediction made by Rice (1984:245-6) that there will be lack of change in production of wares used for basic needs. Consumers do not demand changes in vessel forms that are important in daily activities and that already function adequately. Also, there may have been less consumer demand for changes in production of vessels used in private (household) contexts.

Thus, there is no indication that competition between potters, in response to increasing population size and density, intensified over time, resulting in efforts to produce wares more efficiently. Increasing dimensional standardization is one indicator of change in mode of production, as discussed in Chapter 3. Other categories of data described in Chapter 6 do not indicate change in mode of production over time, either.

However, below I suggest that there was concern with efficiency in production of these shape classes. Some vessels appear to have evidence for relative lack of labor input in shaping and decorating. Thus, vessels in these shape classes, were, on the whole, non-prestige wares (as defined in this study).

Relative Lack of Labor Input in Production

At Hougang and Lujiakou, there are three types of evidence that may indicate relative lack of labor input in production: shaping, decorating, and firing (Tables 21-22). Some wan bowls from each period at Hougang have evidence for lack of labor input in shaping. There is a lump in the center of the interior base; potters did not take time to smooth it over. Since reconstruction of vessels with plaster probably often covers the evidence, it is not possible to identify whether there is an increase or decrease in the number of bowls of this type over time. Some ding tripods at Lujiakou have incomplete incised lines that should have continued around the circumference of vessels (in comparison to incised lines on other vessels), and an uneven surface color indicative of relative lack of effort in firing.

There is additional evidence for relative lack of labor input in production at Hougang for large guan jars and medium-sized pingdipen basins. I saw one large jar from the Late Period and two basins (one from the Middle Period, one from the Late) with incompletely incised lines.

In the Hougang and Meishan reports, there is information on change over time in quality of decorative techniques for all vessels with

Table 21. Suggested Evidence for Relative Lack of Labor Input in Vessel Forming for Wan Bowls, Class One, Hougang.

lump of clay in center of interior base	Early	Middle	Late
present	1	7	6
absent	9	8	13
total number of vessels	10	15	19

Table 22. Suggested Evidence for Relative Lack of Labor Input in Decoration and Firing for Ding Tripods, Class Seven, Lujiakou.

type of evidence	Early	Late
uneven firing present	2	1
absent	1	3
uncompleted incised lines present	1	2
absent	2	2
total number of vessels	3	4

impressed decoration. Impressed decoration is placed with more care in the Early Period at Hougang, and it is neatly applied and relatively deep. Pots from the Middle and Late Periods have relatively crude, more shallow impressed decoration (Anyang Archaeological Team, IA, CASS 1985:79, 81). Thus it appears that by the Middle Period, potters decided to spend less time in decorating guan jars presumably for reasons of efficiency, even though they did not form them more efficiently.

A similar trend in quality of impressed decoration over time is present among the Meishan vessels. In the Early Period, impressed decoration is relatively neat and deep. By the Late Period, this type of decoration is not as carefully applied (Second Henan Archaeological Team, IA, CASS 1982:472-3). In addition, vessel shapes are said to have become "less orderly" over time at Meishan, perhaps indicating that they were produced more quickly than previously. There are unevenly and low fired vessels in the Late Period as well (Second Henan Archaeological Team, IA, CASS 1982:447, 473).

The change in relative care in execution of impressed decoration from the Early to Middle Period at Hougang correlates with the marked decline in diversity of shape classes. There is no evidence for extreme stress on the cultural system. A more plausible explanation is that vessels with impressed decoration, and perhaps other classes as well, were valued less by consumers over time. Some vessels may have been used for display during the Middle and Late periods at Hougang, as discussed later in this chapter. These vessels do not have impressed decoration.

The decline in variety of shape classes from the Early to Middle Period at Hougang may represent the opposite process that Miller (1982) describes. A decrease in variety of shape classes over time may signal a decline in demand for a variety of vessels for use in social displays. The more widespread decline in care in production by the Late Period at Meishan may indicate that pottery vessels, as a class of materials, were considered less valuable than previously, particularly for social display at inter-household events.

Within-class Standardization

This section describes variation in secondary shape features and techniques of decoration within shape classes. An increase in varieties of decorative techniques over time, for example, indicates diversification. Conversely, a decrease in varieties of decorative techniques signifies simplification. Although there is relatively little relevant information for each site, the patterns that emerge tend to support the conclusions reached in the analysis of change in diversity of shape classes. Details on this analysis are provided in Appendix B, Tables 57-73.

For Hougang, there is adequate information to assess diversity in shape of leg for xian tripods and ding tripods, as well as handles for xian tripods. Again, it is necessary to standardize the figures by total number of houses excavated per phase, as a rough measure of volume of excavated earth per phase. Unfortunately, sample size is so small (even when categories are lumped) that division by quantity of houses results in very small figures that are difficult to compare.

Some patterns can be seen from the raw data for Hougang in the tables (Appendix B, Tables 57-59). In more than one case, increasing diversity in secondary shape features is directly related to sample size (handles for xian tripods, for example). However, for shape of leg, xian tripods, there seems to be simplification over time. Even though the number of excavated houses increases markedly from the Early to Middle and Late Periods, the total number of varieties in leg shape does not. The same pattern may apply to shape of leg for ding tripods.

Four comparisons of diversity in decorative techniques over time at Hougang are possible: large guan jars, medium-sized guan jars, xian tripods, and wan bowls, class one (Appendix B, Tables 60-63). There appears to be a pattern of simplification from the Middle to Late Period: large jars, xian tripods, and bowls. Similarly, simplification may characterize medium-sized jars from the Early to Middle Period.

Two comparisons for Baiying suggest a pattern of simplification from the Middle to Late Periods: handles and decorative techniques for ding tripods (Appendix B, Tables 64, 65). Although the number of excavated houses increases markedly from the Middle to the Late phase (a jump from 8 to 46), the varieties of handles and decorative combinations do not. The analysis of diversity of shape classes indicated a pattern of simplification from the Middle to Late Period at Baiying as well.

Comparison between phases at Meishan and at Lujiakou is more straightforward, since an approximately equal number of houses was excavated from each phase. For Meishan, each of four comparisons suggests the same pattern, conservatism over time: decorative techniques on guan jars, dou stemmed dishes, and ding tripods; and shape of leg for ding tripods (Appendix B, Tables 66-69). The same pattern was obtained, then, for the analyses of diversity in shape classes and within-class standardization. For Lujiakou, three of four comparisons suggest a pattern of diversification, again an agreement of the first analysis conducted: 1) decorative techniques for ding tripods, 2) decorative techniques for wan bowls, and 3) handles for ding tripods (Appendix B, Tables 70-73).

Clearly, larger sample sizes should be used to support or reject these conclusions. It would be helpful to calculate diversity formally by a technique such as the Shannon-Weaver Diversity Index used in other studies of ceramic production (Rice 1981, Toll 1981). Also, it is necessary to evaluate observed differences in diversity by means of significance tests (Rice 1989:112).

It would be worthwhile to assess diversity of other types of secondary shape features and decorative techniques on vessels from

Longshan sites. When examining vessels in China, I noted several other types of variation that could not be investigated further due to inadequate sample size. For example, guan jars (medium and large) at Hougang vary in placement of impressed decoration. Impressions may cover the complete lower part of the body, or stop before the base. There is also variation in quantity of incised lines that go around the circumference of vessels. Some jars from Hougang have what appears to be a lid shelf. The report states that the inner edge of the rim on these vessels becomes a ridge (Anyang Archaeological Team, IA, CASS 1985:68). Lid shelves are known for large jars from the Wangyoufang region in Henan as well (Zhang and Zhang 1986:46-7).

Finally, some variation in type of paste may stem from social causes and be relevant to the model of ceramic change. White wares are rare and appear at approximately the same time period in northern Henan, ca. 2300-2100 B.C.: during the Late Period at Hougang (Anyang Archaeological Team, IA, CASS 1985:56, 81) and the Middle Period at Baiying (CPAM of Anyang District, Henan Province 1983:27). There is very little information on white wares in the reports. One shape class made of this ware (a kaolinic clay) is a small gui pitcher.

Vessels made from this qualitatively different and relatively restricted clay source may have been prestige wares. They are rare within the Hougang and Baiying assemblages. White wares had been used in Shandong since the Dawenkou Period (Underhill 1983). During the Longshan Period, people in the Hougang II region may have sought to enhance their positions of status by introducing a new ware used in another region.

The Late Formative Period in the Valley of Guatemala may be an appropriate analogue. Rice (1977) shows that elites probably controlled production and exchange of rare, finely made white wares. In the case of Hougang and Baiying, however, there is no published information on context of deposition or exchange.

Summary of Changes in Strategies of Production

Similar results were obtained in three separate analyses: diversity of shape classes, dimensional standardization, and within-class standardization (Table 23). The westernmost site, Meishan, is characterized by a pattern of conservatism over time, or resistance to change, on the basis of all three analyses. The pattern for Hougang is simplification in diversity of shape classes and within-class standardization, and conservatism in dimensional standardization. There is more than one pattern for Baiying. Unlike Hougang but similar to Lujiakou in Shandong, there is a pattern of diversification for variety of shape classes from the Early to the Middle Period. There is no information on change in dimensional standardization. There is a more clear pattern of increase in variety of shape classes produced over time

Table 23. Summary of Change in Strategy of Pottery Production at Hougang, Baiying, Meishan, and Lujiakou.

(note: "E"= Early, "M"= Middle, "L"= Late Period)

site and region	diversity of shape classes	dimensional standard-ization	within-class standard-ization
Hougang II			
Hougang			
E - M	modest simplifi-cation	conservatism for jars, bowls, basins	simplification? (1 comparison)
M - L	modest simplifi-cation	same as above	simplification? (5 comparisons)
Baiying			
E - M	modest diversifi-cation	no data	conservatism? (2 comparisons)
M - L	conserva-tism	no data	simplification? (2 comparisons)
Wangwan III			
Meishan			
E - L	conserva-tism	conservatism jars, tripods	conservatism? (4 comparisons)
Liangcheng			
Lujiakou			
E - L	diversifi-cation, especially open forms	conservatism tripods	diversification? (3 of 4 comparisons)

at Lujiakou compared to the other three, more western sites. But there is a pattern of conservatism in dimensional standardization.

There are interesting implications of these results. One is the variation in patterns for the different sites, underscoring the point that there was regional diversity during the Longshan Period. There is variation within one region, Hougang II, as well. Each site exhibits variation, supporting the hypothesis of Rice (1984) that different components of ceramic production systems do not always change in the same manner.

Similarities in results for different analyses pertaining to one site are encouraging, suggesting that the small samples of vessels examined here provided relatively accurate patterns. The analysis of within-class standardization gave particularly tentative results, but results which tend to support the analysis of diversity in shape classes. Similarly, there is relatively little information available for the Early Period at Hougang, but two analyses gave similar results.

Meishan belongs to the Wangwan III type in western Henan, the region in which state formation probably first took place. It is commonly assumed that culture becomes increasingly complex in all subsystems during the process of state formation. However, the analyses conducted here suggest that the system of pottery production may not have changed significantly over time. There is no clear evidence for intensification or increasing efforts to produce vessels more efficiently. The only possible indication of increasing efficiency in production is the potential evidence for increasing incidence of lack of labor input. Similarly, there is no evidence for diversification, another important aspect of increasing specialization in ceramic production (Rice 1981:220). A serious problem is that there is relatively little information on ceramic vessels at Meishan in comparison to other sites. It is necessary to examine more vessels from the Wangwan III region to verify these findings.

There is a more complete picture of change in ceramic production in the Hougang II region. A pattern of modest simplification characterizes the change from the Early (transitional to the Longshan Period) to the Middle Period at Hougang. There may have been a decline in demand for a variety of vessels by consumers for social display. From the Early to Middle Period as well, it appears that there was a decline in labor input for applying impressed decoration.

Analyses either indicate a pattern of simplification or conservatism for the Middle to Late Period at Hougang. For each site, I suggest that the shape classes with the largest samples of vessels represent functional types that were common and regarded as non-prestige wares: <u>xian</u> and <u>ding</u> tripods, <u>guan</u> jars, and <u>wan</u> bowls. Some vessels at Hougang, for example, exhibit evidence of lack of labor input in production.

For each site there were insufficient data to assess within-class standardization and dimensional standardization for other wares. The patterns summarized in Table 23 may not characterize change in production of prestige wares. The case of Baiying indicates that patterns of change in prestige wares may differ from non-prestige wares. Potters may have diversified production of vessels that could be used in social displays from the Early to the Middle Period: cups, serving lids, and pitchers.

Some aspects of ceramic production in the Hougang II region may have been caused by cultural interaction with Shandong, such as diversification of shape classes that could be used for display at Baiying and the introduction of white wares at Hougang and Baiying. These suggested patterns, and those described in the following section, appear to support the hypothesis proposed by Rice (1981) that diversification of ceramic production in a context of increasing cultural complexity should occur primarily in the area of status-related vessels.

ANALYSIS OF CHANGE IN LABOR-INTENSIVE (PRESTIGE) VESSELS

The model suggests that two types of displays with containers were common in prehistoric chiefdoms, largesse and conspicuous consumption. Displays of largesse tend to be undertaken by higher status people who have resources to give food and drink away to others. Generosity is an important method of maintaining and increasing supporters. Large vessels symbolize the generosity of the donors. Displays of largesse, on a smaller scale, may be undertaken by families at inter-household social events such as marriage ceremonies and funerals. In displays of conspicuous consumption, people display personal consumption of food and drink with vessels that are elaborate in shape, have thin walls, or have a number of decorative techniques.

When there is an increase in status competition and pottery vessels are prestige objects, there should be an increase in degree of variation in labor input among vessels. People may attempt to surpass the displays of others by acquiring: 1) the same types of vessels, but exhibiting a higher degree of labor input, 2) vessels exhibiting new types of labor-intensive techniques, and/or 3) acquiring an increasing variety of shape classes exhibiting labor-intensive techniques. Conversely, when the competitive system declines, the opposite pattern will occur.

It is possible to identify the presence of four types of labor-intensive vessels at Hougang, Baiying, Meishan, and Lujiakou: 1) very large, 2) elaborate in form, 3) thin-walled, and 4) polished (Table 24). Unfortunately, it is not possible to identify the total number of labor-intensive vessels at these sites on the basis of information presented in site reports. However, as reports tend to describe at least one vessel representing each ceramic category (Chapter 4), the varieties of labor-intensive vessels that are present can be inferred. In my estimation, Table 24 lists the total quantity of very large vessels that were excavated at sites. It should list most of the thin-walled and

Table 24. Labor-Intensive Vessels That May Have Been Used For Display at Hougang, Baiying, Meishan, and Lujiakou.

(note: "E"= Early, "M"= Middle, "L"= Late Period; *= several decorative techniques present on one vessel)

site and region	very large in size	thin-walled	elaborate form	polished surface
Hougang II				
Hougang	E: 2 zuo stands *		lids for serving: 3 forms, 4 pots	pots in several shape classes
	M: 1 basin polished pingdipen	1 jar guan (medium-sized)	lids for serving: 3 forms, 5 pots	pots in several shape classes
	L: --	1 jar guan (medium-sized)	lids for serving: 2 forms, 6 pots	pots in several shape classes
Baiying	E: 1 zuo stand *, polished; 1 lid, 1 basin polished	1 cup bei	lids for serving: 2 forms, 2 pots	pots in several shape classes
	M: --	2 pitchers 1 cup bei	lids for serving: 3 forms, 4 pots	pots in several shape classes

	L: --	--	lids for serving: 6 forms, 7 pots	same as above, and 1 * quanzu-pan with painted human figures
Wangwan III				
Meishan	E: --	E: 1 cup bei 1 tripod ding	lids for serving: 2 forms, 3 pots	pots in several shape classes
	L: --	L: --	lids for serving: 2 forms, 3 pots	pots in several shape classes
Liangcheng				
Lujiakou	E: --	E: hu jars (quantity not clear)	gui pitchers with long spouts: 1 form, 3 pots	pots in several shape classes
	L: --	L; --	gui pitchers with long spouts: 1 form, 1 pot; lids for serving: 1 form 1 pot; 1 lei jar	pots in several shape classes

elaborately shaped vessels. There are probably several polished vessels in several shape classes at each site, most of which are not described in reports.

Two sites, Hougang and Baiying, have relatively large vessels. At both of these sites there are large _zuo_ stands and one extremely large _pingdipen_ basin. The basin at Baiying is particularly large, with a rim diameter of 77.4 cm. The basin at Hougang is 60.7 cm in rim diameter. At Baiying there is also an extremely large lid shaped like a sombrero at 56.0 cm in rim diameter. The scatterplots for size of basins at Hougang and Baiying (Appendix A, Figures 8, 10) illustrate the extent to which these vessels differ from others. The _zuo_ stand at Baiying, completely reconstructed, is 45.5 cm in rim diameter and 29.4 cm in height. Many of these vessels also exhibit labor-intensive decorative techniques. The basins are highly polished, and the _zuo_ stands have several techniques: painting, carved out holes, polishing, and incising.

All of these vessels belong to the earlier Longshan Period: the Early and Middle Period at Hougang, and the Early Period at Baiying. These large vessels may represent display of largesse in giving food or drink to other people. Large ceramic basins used for this purpose are known in Peru (Tschopik 1950:215-6). I suggest that largesse was a social tactic used at more than one community in the Hougang II region during the earlier Longshan Period.

There is also one distinctly large _guan_ jar from the Late Period at Baiying, with a height of 55.8 cm (Appendix A, Figure 6). It is possible that this vessel was also used in displays. However, jars of this size are not an unusual occurrence in northern Henan. At Hougang, gang jars are present in every period and are approximately the same height. They may have been used for storage in private (household) rather than public contexts.

As mentioned in the first section of this chapter (Table 18), I suggest that there are several forms of lids too elaborate in form and/or too large and heavy to function as covers of other vessels. These are present in each period at Hougang, Baiying, Meishan, and Lujiakou. From the Late Period at Baiying, there are also two large lid handles of elaborate shapes, one of which is at least 22.6 cm tall. From the Late Period at Meishan, there are two elaborate lid handles, one of which is shaped like the head of a wolf. There are other forms of elaborately shaped vessels at Lujiakou. The lei necked jar is only present in the Late Period, but gui pitchers with exaggerated (long) spouts are in each period.

Vessels with thin walls are present in more than one period and region, but to a greater extent at Baiying and Lujiakou. The small pitchers from Baiying are on display at the Puyang work station. They are extremely finely made and very thin-walled, at ca. 1.0 mm. The Early Period sherd from a cup of uncertain shape is said to be "eggshell" thin (CPAM of Anyang District, Henan Province 1983). At Lujiakou, some hu necked jars are thin-walled.

There are vessels in a number of shape classes that are polished. Some classes exhibit variation in degree of luster on vessels as well. A few bei cups, zun cups, and dou dishes from the Middle and Late periods at Baiying have a high degree of luster (CPAM of Anyang District, Henan Province 1983:17, 19, 28). Unfortunately, it is not possible to describe variation in polishing among vessels in any detail. When vessels were examined in the field, extensive smearing of plaster from the reconstruction process prevented accurate comparison of vessels.

I suggest that thin-walled, polished, and elaborately shaped vessels were used in displays of conspicuous consumption throughout the Longshan Period. Individual-sized vessels such as cups could have been used, as well as serving vessels such as necked jars that could have contained alchohol. The large and elaborate lids could have been used in either displays of largesse or conspicuous consumption. The same hypothesis can be offered for polished open forms. The unusual painted quanzupan dish from the Late Period at Baiying may represent display of ritual status instead.

In most cases, it is not clear whether displays of largesse or conspicuous consumption became more intensified over time as a result of increasing status competition. However, there is some indication that displays of conspicuous consumption may have intensified over time in the Hougang II region. Vessels became increasingly thin-walled from the Early to the Middle Period at Baiying (CPAM of Anyang District, Henan

Province 1983:37), and from the Middle to Late Period at Hougang (Anyang Archaeological Team, IA, CASS 1985:81). As previously discussed, these phases are roughly contemporaneous. Also, white wares were introduced at this time.

It appears that there is a change in character of display vessels in the Hougang II region over time. Large vessels seem to drop out by the later Longshan Period. I suggest that people in status competition decided to adopt a different tactic, displaying a variety of shape classes exhibiting labor-intensive production as well as personal consumption of food and drink.

Again there is evidence for a decline in pottery production over time at Meishan. In the Late phase, extremely thin-walled vessels are not present. Also, the number of vessels with polishing declines over time. Vessels from only the Early Period have a high degree of polishing (Second Henan Archaeological Team, IA, CASS 1982:273-4).

In contrast, there is an increase in polishing for vessels from Lujiakou (Shandong Archaeological Team, IA, CASS and the Art Museum of Weifang County, Shandong Province 1985:348). One sherd of eggshell thickness (ca. 1 mm) was found, of unspecified date. Displays of status with pottery may have continued with greater intensity in Shandong and northern Henan than in western Henan during the late Longshan Period.

The patterns describe here appear to be present at other, less well documented sites from the Longshan Period. Very large containers occur at three sites dating to the earlier Longshan Period (Table 25).

Table 25. Very Large Vessels at Other Sites from the Longshan Period.

<u>cultural region</u> / <u>site</u>	<u>characteristics of vessels</u>
<u>Taosi</u>	
Taosi (Xiangfen County, Shanxi) Early Period dates ca. 2500-2300 B.C. (Zhang and Zhang 1986:51, Gao et al. 1984:28)	1 wooden, red painted <u>quanzupan</u> stemmed dish in Early Period grave M3015, a large and the richest grave at the site (178 grave goods), rim diameter of dish= 63.6 cm, height= 22.0 cm (Shanxi Archaeological Team, IA, CASS and the Linfen District Cultural Bureau 1983:31,35,39)
<u>Wangwan III</u>	
Wangwan (near Luoyang city, Henan) layer III, one C14 date for site, ZK 126, 2390+/145 B.C. (Zhang and Zhang 1986:53)	1 pedestalled <u>pen</u> dish, polished, on display at the Archaeological Work Station, Luoyang, Henan, rim diameter= ca. 54.7 cm, height= ca. 30.6 cm, and 1 <u>guan</u> jar, rim diameter= ca. 41.5 cm, height ca. 65.0 cm; 1 large <u>zuo</u> stand (polished, incised, with carved out holes) on display at the National History Museum, Beijing, rim diameter= ca. 45.0 cm, height= ca. 28.0 cm
<u>Hougang II</u>	
Xiapanwang (Cixian County, Hebei) (one C14 date for site, ZK 200-1, 2515+/145 B.C. applies to F1 (Zhang and (Zhang 1986:52)	1 <u>pingdipen</u> basin of same shape class as the large basin at Hougang) from house F1, rim diameter= 61.2 cm, height= 14.0 cm (Department of Cultural Relics, Hebei Province 1975:92)

Significantly, the grave at Taosi shows an association between large vessels (wooden, in this case) and high status users or owners (see Shanxi Archaeological Team, IA, CASS and the Linfen District Cultural Bureau 1983:31, 35, 39). Thus, displays of largesse may have occurred in more than one area, not just northern Henan. A large pingdipen basin has been reported for a third site in the Hougang II region, Xiapanwang (Department of Cultural Relics, Hebei Province 1975:92).

Other types of labor-intensive vessels have been found that must have been used in displays of status. Thin-walled, polished, and tall (exaggerated height) vessels are reported at other sites from the Wangwan III, Hougang II, and Liangcheng regions (Table 26). Information on polishing is limited, but it appears that most of the vessels in question were polished.

Sites from Henan have yielded thin-walled vessels of more than one shape class, particularly cups. In the Liangcheng region of Shandong, the only form of thin-walled vessel is the well-known "eggshell" (dan ke tao) tall stemmed cup (gao bing bei). These vessels, of remarkable thinness (as low as 0.3 mm) are associated primarily with mortuary sites. They are rare in habitation contexts; the site of Yaoguanzhuang is one example (see Institute of Archaeology, Shandong Province et al. 1981:22). "Eggshell" tall stemmed cups represent the climax of ceramic technology during the Neolithic period (Yan 1986, Du 1982).

Thin-walled vessels were probably made first in Shandong, ca. 2400 B.C., and next in the adjacent Hougang II region. They are

Table 26. Labor-Intensive Vessels that May Have Been Used for Display of Conspicuous Consumption at Other Sites from the Longshan Period, by Cultural Region.

type of vessel	Wangwan III	Hougang II	Liangcheng
thin-walled cups - varieties of bei			
short	1, Wangchenggang, Period IV, polished, ca. 1900 B.C.	1, Dahancun no date given less than 2.0mm thick	--
tall stem- gao bing bei	1, Wadian, Period II, C14 date for site WB82-24 2080+/135 B.C., (associated period not stated), reported as ca. 0.1mm thick, also polished, incised, with small carved out holes	--	several in burials at sites ca. 2400-1800 B.C. most pots 0.3-0.5mm thick, polished, some with small carved out holes; at Chengzi, Sanlihe
thin-walled beakers- varieties of gu	1 polished bei shaped like a gu, Niuzhai, no clear date	--	--

thin-walled lids- varieties of <u>gai</u>	1, Wadian, period not stated 1, trumpet-shaped, ca. 24.5 cm tall, polished, at Yanzhuang, ca. 1.0 mm thick, ca. 2175 B.C. 1, same shape as above, ca. 28.0 cm tall, brightly polished, 1.2-1.8 mm thick, at Gelawang, late Longshan Period	--	--
tall beakers- varieties of <u>gu</u>	2, Wadian, Period II, polished, broken heights 21.5 cm, 14.5 cm; 2 from Period III, brightly polished, elaborate in shape, 25.2 cm, 29.0 cm in height	--	--

	polished, 1, Wangchenggang Periods II, IV, both ca. 20 cm tall, (ca. 2455, 1900 B.C.)		
tall pitchers-varieties of gui, exaggerated necks and/or spouts	--	--	several in burial and other sites ca. 2400-1800 B.C., vessels up to 42.0 cm tall (Yao-guanzhuang, middle-late Longshan Period

References:

1) Wadian (Yuxian County, Henan), some vessels on display at the Dengfeng (Gaocheng) Archaeological Research Station, and described by the Henan Province Cultural Research Institute and the Department of History at Zhengzhou University, Archaeology Specialty 1983:41,43; for dating see Zhang and Zhang 1986:53

2) Wangchenggang (Dengfeng County, Henan), several vessels on display at the Dengfeng (Gaocheng) Archaeological Research Station, and described by the Henan Province Cultural Research Institute and the Archaeological Section of the Museum of Chinese History 1983:13,16; for dating see Zhang and Zhang 1986:53

3) Niuzhai (near Zhengzhou city, Henan), Cultural Relics Work Team, Bureau of Culture, Henan Province 1958:22-3,26

4) Yanzhuang (near Zhengzhou city, Henan), Museum of Zhengzhou City 1983:5), for dating see Zhang and Zhang 1986:53

5) Gelawang (near Zhengzhou city, Henan), First Cultural Relics Work Team, Bureau of Culture, Henan Province 1958:46,47

6) Dahancun (near Anyang city, Henan), Anyang Archaeological Team, IA, CASS 1990:55,56

7) Chengzi (Zhucheng County, Shandong), Archaeological Group of the Changwei Area and the Museum of Zhucheng County 1980

8) Sanlihe (Jiaoxian County, Shandong), Institute of Archaeology, Shandong Province 1988

9) Yaoguanzhuang (near Weifang city, Shandong), Institute of Archaeology, Shandong Province et al. 1981:14-7

present in the Early Period at Baiying but appear to be more common by the Middle Period. From there they spread further west. It is possible that consumers attempted to emulate high status people in adjacent regions. Using copies of display vessels made in other areas is a common strategy in social competition (Miller 1982:193).

Again, similar forms of vessels that may have been used for social displays are found in more than one site within cultural regions. For example, in the Wangwan III region, a trumpet-shaped, polished, thin-walled lid is present at Yanzhuang (Museum of Zhengzhou City 1983:5) and at Gelawang (First Cultural Relics Work Team, Bureau of Culture, Henan Province 1958:46, 47). "Eggshell" tall stemmed cups are found in several sites in Shandong.

Conclusions on Changes in Labor-Intensive (Prestige) Vessels

Large, thin-walled, polished, and elaborate vessels are found in a number of sites in more than one phase during the Longshan Period. Significantly, similar patterns are found in more than one site within the same cultural subregion. I suggest that persons in status competition emulated the displays of others -- people in the same settlement system as well as in other communities or even other regions. People in northern Henan, particularly at the site of Baiying, may have attempted to emulate the display tactics of people in Shandong. This process may have intensified from ca. 2300-2200 B.C. (by the Middle Period at Baiying and the Late at Hougang).

It appears that display vessels continued to be used at Meishan, even though there is potential evidence for decline in production of prestige wares by the Late Period. Other sites from the Wangwan III region have yielded labor-intensive vessels that may have been used for display as well. An exquisite, very tall, well-polished gu beaker was found from Wadian. Thus it appears that prestige wares continued to be important during the later Longshan Period in this region. One reason for differences in patterns between sites in the Wangwan III region may be that metal vessels were beginning to replace ceramic vessels as prestige goods.

In the future a larger sample of vessels from Longshan sites should be examined for variation in labor input, enabling a more precise comparison of vessels by the production step index (Feinman et al. 1981). It is necessary to document change in production of (labor-intensive) prestige wares more clearly. This analysis suggests that all three types of change driven by increasing status competition cited previously may have taken place: increasing degree of labor input for the same type of shape classes (Baiying), using vessels with new types of labor-intensive techniques (Hougang, Baiying), and acquiring a greater variety of vessels with labor-intensive techniques (Baiying, Lujiakou). These changes represent an increase in varieties of ceramic categories over time as predicted by my revised version of the model by Rice (1981).

CHAPTER 6. CHANGE IN MODE OF PRODUCTION AND ACCESS TO GOODS

INTRODUCTION

This chapter addresses two topics. The first is archaeological evidence for mode of pottery production. As discussed in Chapter 3, the following modes may be represented in chiefdoms: household production, simple household industry, complex household industry, and individual workshop industry. The chapter addresses whether there is evidence to support the hypothesis raised in the Chinese and western literature that workshop production was present during the late Neolithic period of northern China. Also, it attempts to determine whether there is evidence for a change in mode over time at sites, as predicted by the model.

As discussed in Chapter 3, patterns of standardization and diversity of ceramic vessels can be useful in recognizing change in mode of production. Two other categories of archaeological data that can be informative as well are direct evidence for pottery production (kilns, tools, etc.) and techniques used in production (for shaping, firing). The limited data on ceramic vessels, direct evidence for production, and specific techniques suggest that there is no evidence for change in mode of production at any site. Also, the mode that is most likely is complex household industry. Other Longshan sites have similar evidence for pottery production.

The second topic addressed here is patterns of access to craft goods at Hougang, Baiying, Meishan, and Lujiakou. One important issue is whether there is evidence for differential access to goods for large sites with walls versus smaller sites without walls. In chiefdoms, relatively large settlements with substantial architectural features are usually centers in which residents have restricted access to a range of craft goods. As discussed in Chapter 2, Hougang is reported as much larger in size than the other three sites and has remains of a surrounding wall. I compare the types and quantities of ceramic and nonceramic goods found at the four sites -- potential prestige items and utilitarian items.

Another important issue is whether there is evidence for change in patterns of access to goods at an intra-site level. The analyses in Chapter 5 suggest that display activity with pottery vessels is present throughout the Longshan Period in more than one region. Also, there may have been an increase in intensity of display activity over time in the Hougang II and Liangcheng regions. For example, it appears that vessels become increasingly thin-walled over time in the Hougang II region. In chiefdoms, status competition often involves more than one category of material goods. It is important to investigate whether other goods indicate status competition as well, and whether there is evidence for change in degree of competition over time.

First, I describe variation in diversity and quantity of artifacts at each site, potential prestige items and utilitarian objects. Then I discuss variation in size and construction material of houses at the four sites. There is much more information for Hougang and Baiying than Meishan and Lujiakou. On the whole, there is little indication that the occupants of Hougang had access to a greater variety and quantity of goods than the other sites. However, differentiation in housing at Hougang and Baiying becomes more marked over time. Unfortunately, since few ceramic and nonceramic goods were recovered from houses, there is no independent data on status of consumers of hypothesized prestige items. Conclusions about possible changes in access to goods at sites is discussed rather than details about consumption of goods.

EVIDENCE FOR MODE OF PRODUCTION

Since Chapter 3 describes how ceramic attributes reflecting degree of standardization and diversity can indicate mode of production, this section outlines proposed expectations concerning the other two relevant categories of data, direct evidence for ceramic production and ceramic technology. Then it describes the available data for sites.

Table 27 summarizes the expected archaeological evidence for change in mode of production in chiefly societies. Change in productive mode is more readily identifiable by change in direct evidence for production. If only ceramic vessels and techniques used in production

Table 27. Hypothesized Archaeological Indicators for Change in Mode of Production.

type of evidence	household to simple household industry	simple household industry to complex household industry	complex household industry to individual workshop industry
change in direct evidence for pottery production: tools, kilns, pots in houses	change from evidence for production in most houses or several areas to a few	no change; evidence for production in only a few houses or areas	change from production in few houses to no houses; remains of workshops
change in technology		change in techniques to increase efficiency in shaping, firing	same as above
change in characteristics of ceramic products	increases in degree of standardization and/or diversity in terms of size, shape, decoration	same as above	same; result is high degree of standardization and diversity

are examined, it may not be possible to ascertain whether there is a change in mode. Instead, the data may indicate evidence for increasing efficiency in production with no change in mode. Ideally, all three categories of data should be examined in assessing mode of production.

Unfortunately, it is often difficult to identify direct evidence for ceramic production from archaeological remains. Researchers need to be aware of potentially useful data during excavation (Stark 1985, Deal 1988). Analysts can predict expected categories of data on the basis of production techniques used by modern traditional societies in general (van der Leeuw 1984) and in specific areas. For example, researchers have used ethnoarchaeological data from the American southwest (Sullivan 1988) and Mesoamerica (Stark 1985, Deal 1983, 1988) to predict useful categories of data. I review evidence for pottery production in Chinese Neolithic and early historic sites in order to identify relevant classes of data that may be present at Hougang, Baiying, Meishan, and Lujiakou.

It is often profitable to examine ceramic vessels for specific techniques used in production (Santley et al. 1989:111). Here I discuss general information from the archaeological literature on techniques of production.

Ideally, household production should be recognizable by material evidence for production in or near each house in a settlement. Craft specialization within a settlement should be recognizable by remains of production in a limited number of areas, for both simple and complex household industry (see Tosi 1984:23-4). A change to workshop production should be recognizable by the appearance of workshops. There should be a concentration of permanent facilities for different steps in production such as preparing paste, shaping, decorating, and firing (Santley et al. 1989:109).

A number of factors may complicate archaeological recognition of pottery production, especially when clearly identifiable workshops are absent. The presence of portable items such as tools in an area does not necessarily indicate that production took place in that area (Stark 1985:167). Immovable features such as kilns provide more reliable evidence for production. Some steps in production involving clay soaking pits and wheels, etc. may take place in courtyards adjacent to houses, as in Indian villages with complex household industry (Miller 1985:209). Conclusions about location of production are more reliable when a range of archaeological data is examined (Stark 1985:177).

In most studies, production areas are located by identifying tools, kilns, and wasters. In recent years other criteria have been used such as relative concentration of residues from production over a site (Tosi 1984:23, Santley et al. 1989), presence of raw material storage (Deal 1988, 1983), and identification of tools from use-wear analysis (Deal 1988). However, the present study is limited to identifying tools and kilns as described in archaeological reports.

This study also considers another potential indicator of ceramic production proposed by Deal (1983:111): presence of a great diversity and quantity of vessels in houses where potters reside. This criterion should apply to the household and household industry modes. An obvious problem in using the criterion is the difficulty in determining whether a great variety and quantity of vessels in a house indicates a high status family rather than the household of a potter. A high status family should symbolize its social position by more than one category of material remains. A house with a great variety and quantity of vessels should be relatively large in size, built with construction materials of relatively good quality, and/or contain other prestige goods.

I suggest that a change in mode of production may also be indicated by technological changes to increase efficiency, i.e., to produce a greater number of vessels in a shorter time period. Greater speed can be achieved by increased use of moulds as well as wheels (Arnold 1985:209). For example, using moulds to make a greater number of shape classes can increase efficiency in production. Another solution is to make changes in kiln design. For example, the size of a firing chamber limits the number of vessels that can be fired at one time (Kramer 1985:81). A clear increase in size of firing chamber could indicate efforts at greater efficiency, i.e., by firing a greater quantity of vessels at one time. However, size of baking chamber also relates to size of the vessels being fired.

Evidence for Pottery Production in Chinese Neolithic Sites

There are several types of evidence for pottery production from Neolithic and early historic period sites. Large features include pit (updraft) kilns at several sites (Feng et al. 1982, Zhou et al. 1982), a stone turntable from the Yangshao site Banpo (Zhao 1989), and pits for preparing paste from a Shang site (described by Shangraw 1978:139). Wheels or pits have not been reported from Longshan sites. In addition, pottery, stone, and bone tools for shaping (trimming, smoothing, adjusting shape) and decorating (stamping, incising) vessels have been identified (Zeng 1985, An Zhimin 1982).

Unfortunately most of the tools pictured by Zeng (1985) and An Zhimin (1982) are rather indistinct in shape. Some of the tool forms are illustrated in Longshan site reports. However, it is not possible to ascertain whether most of these tools were used for pottery production or exclusively for other tasks. Therefore I only record the presence of distinctive tool forms from Hougang, Baiying, Meishan, and Lujiakou.

The tool form that is most clearly associated with pottery production is the <u>paizi</u> or "beater". This tool is shaped like a mushroom, i.e., wide and flat at one end, and is small, often about

6 cm tall. _Paizi_ made from both pottery and stone are present in Longshan sites.

Zeng (1985:72) illustrates two types of pottery "beaters", one that has a plain end and one that is covered with decorative lines. Scholars have argued that the latter type was used to make impressed decoration on pots, as an alternative to carved wooden paddles (Feng et al. 1982:39-40). Most _paizi_ from Longshan Period sites are plain at the end. Baiying contains two covered with decorative lines that are slightly different in shape than other _paizi_. A possible alternative technique for making impressed decoration on Longshan vessels is discussed below. Like Cheng (1959:93), I think that the majority of _paizi_ were used as anvils in shaping. Some scholars in China, however, use the term _dian_ to denote anvils (Feng et. al 1982:40).

Small, mushroom-shaped tools of pottery and stone have been identified as anvils in several areas of the world. Rye and Evans (1976) report that specialist potters in Pakistan use more than one size class of these tools for altering the shape of wheel-thrown vessels. Twenty years earlier, Foster (1956) observed specialist Pakistani potters using anvils of this kind for thinning the walls and enlarging the size of wheel thrown vessels. Miller (1985:207-9, 222) also notes that Indian potters use mushroom-shaped anvils with wooden paddles for this purpose.

Facets on the interior walls of vessels are evidence for use of anvils (Rice 1987:136). In my estimation, wheel-thrown bowls and basins at Hougang have facets of this sort, reflecting rapid alteration of shape by beating after throwing.

Table 28 describes the evidence for pottery production at Hougang, Baiying, and Meishan. The lack of evidence at Lujiakou is probably related to the small percentage of the site area excavated. Paizi are the most common tools at sites but other types of tools have been found as well: pottery (zao) chisel and polishing sherds. It is likely that tools made of pottery described as knives or chisels, etc. were used for trimming vessels during the shaping process. The edges would not have been sharp enough for other tasks. Ye and Yu (1984:81), however, argue that pottery tools such as knives were used for agricultural tasks during the Longshan Period. The authors of the Hougang report maintain that 21 sherds show evidence of being used as polishing tools (Anyang Archaeological Team, IA, CASS 1985:71), but only two are described.

When I examined vessels firsthand from Hougang and Baiying, I did not see any of the characteristic striations from burnishing on vessels (see Rice 1987:138), even with a hand lens (16x). Because lustrous black and grey vessels have an extremely smooth appearance, it is likely that polishing was usually achieved by other means. At the Institute of Archaeology in Jinan, Shandong, I was fortunate to meet Zhong Huanan, an experienced potter who has been replicating Neolithic vessels from several periods. He believes that Longshan potters polished vessels before and after firing with a soft material such as cloth or fur (Zhong Huanan, personal communication, July 1987). Leather could have

Table 28. Direct Evidence for Pottery Production at Hougang, Baiying, and Meishan by Excavation (T) Area.

site	pottery chisel	*paizi*	tool for polishing	ceramic mould	kiln
Hougang					
Early		pottery 1 in T2		1 in pit T1-T2	
Middle			2 sherds in pits, T12, T12A		part of kiln wall T16
Late		stone, 1 in T16			
Baiying					
Early					1, T32
Middle	1 in T4				
Late		pottery, 3: T15, T18, and unclear			
Meishan					
Early					5 in corner, T2
Late		stone, 1 in T1			

been used as well (personal communication, Rice 1990). These materials, of course, would not normally be preserved in sites.

Another type of tool that has been discovered, at Hougang, is a pottery mould for forming the legs of li tripods. The mould was first reported in 1961 (Anyang Archaeological Team, IA, Academica Sinica 1961:64-5). In a later report, the Anyang Archaeological Team, IA, CASS (1982:578) states that the mould is 11 cm tall and was found in pit H12. According to their final report for Hougang published in 1985, this pit belongs to the Early Period. The mould is on display at the Xiaotun Research Station.

Moulds were commonly used for shaping vessel legs during the Neolithic period (Feng et al. 1982:38), but it is not clear if moulds were used for making the bodies of vessels. I suggest that the bodies of jars with impressed decoration such as guan might have been made by using moulds. The impressed decoration such as cordmarks are deep, vertical, and extremely regular for the entire length of the vessels. Also, the marks do not overlap with one another. This type of surface could not have been achieved by beating with cord-wrapped paddles or engraved paizi. A ceramic or wooden mould lined with cord, basketry, or fabric could have been used. This technique would also facilitate removal of leatherhard vessels from moulds without sticking (Rice, personal communication 1990).

Some scholars suggest that moulds may have been used to make vessels with impressed decoration (Zhou et al. 1982:272, Wu 1938). Wu

(1938:133-4) maintains that a "belt-mould" rather than a true mould was used to create the deep, regular impressions on jars. He concludes after experimentation that a curved strip of wood, bamboo, or pottery about 2 inches wide and 10 inches long was used when forming large jars by coiling on a turntable (Wu 1938:31-2).

Further experimentation and detailed examination of vessels will help determine techniques used for making various shape classes. The Anyang Archaeological Team, IA, CASS (1985:56) states that the bodies of large vessels such as guan, pen and xian steamers were made by moulds (mu zhi). The rims of these jars were wheel turned (lun xiu), and the bases, wheel thrown. The largest vessels such as large guan and gang were coil made (ni tiao pan zhu), with wheel-turned rims. Most smaller vessels were made by fast wheel (lun zhi). Similarly, the CPAM of Anyang District, Henan Province (1983:27) states that large forms at Baiying such as xian and jia tripods were made by moulds and the wheel.

In both reports the implication is that pottery making techniques are consistent over time for all classes of vessels. Also, there is agreement among scholars that potters made several shape classes by assembling separately fabricated parts throughout the Longshan Period, whether the parts were made by a mould, the wheel, or the coil method. My brief observations on shaping methods at sites support these conclusions.

Kilns were found at Baiying and Meishan (Table 28), but unfortunately, none of the kilns from Baiying are described in the report. Only one kiln from the Early Period is mentioned, Y3. Given the designation, probably two other kilns were found at the site as well. All three extremely large vessels from the site described in Chapter 5 (the basin, zuo stand, and lid) were found in the kiln, in addition to a small pitcher. The report does not give the location of the kiln in relation to the Early Period houses.

The Second Henan Archaeological Team, IA, CASS (1982:431) describes four of five kilns from Period I at Meishan. All of the kilns were found in the northwest corner of excavation area (grid) T2. No information on the location of this area within the site or in relation to other features such as houses is given. The chronological order in which the kilns were used is Y3, Y2, and Y1 with Y4. Two of the kilns, Y3 and Y4, are incomplete. There is no relevant information for Y3. The illustrations and descriptions provided indicate no structural change in Y1, Y2, and Y4 over time. The size of the firing chamber is nearly the same for Y2 and Y4, with a maximum diameter of 1 m. Y2 is slightly bigger, at 1.4 m.

The Anyang Archaeological Team, IA, CASS (1985:71) mentions that a small piece of a kiln wall was found at Hougang from a Middle Period stratum in a general excavation area. It is a burnt clump of grass mixed with mud 15 cm long that originated in the fuel chamber.

Evaluation of Change in Mode of Production

The tools, kilns, and vessels from the four Longshan Period sites examined in this study show no evidence of change in mode of production over time. Most likely, the household industry mode characterizes the entire period. However, there may be differences between different types of sites. The individual workshop industry mode could be represented at centers of settlement. In his cross-cultural study of craft production, Clark (1986:31) found that there is a highly significant correlation between community size or social density and diversity of modes of production. Larger samples of data on direct evidence for production, technology, and characteristics of ceramic products are necessary in order to substantiate these conclusions.

Every site except Lujiakou contains direct evidence for pottery production; however, only a small portion of Lujiakou was excavated (see Table 4, Chapter 1). Further excavation should uncover relevant data. At the other three sites, there is evidence suggesting that production took place in a limited number of areas at each site in each period. However, no tool or kiln was found clearly associated with an individual house.

Table 28 lists the excavation (T) areas containing evidence for production. As discussed, the presence of portable tools in an area does not indicate that production took place in that area. A stronger case can be made when there is an association of more than one category of evidence, such as the T1-T2 area from the Early Period at Hougang, as well as the T16-T12 area from the Middle Period. The data at hand do not indicate a significant change over time in number of areas in general with evidence for production at any site.

Very few pots were found in houses at Hougang, Baiying, Meishan, and Lujiakou. The exception to this pattern is one house from the Middle Period at Baiying, F55. Given the relatively large quantity and diversity of pots found in it, F55 may have been occupied by a potter, according to the criterion proposed by Deal (1983). This house is located in T4, the area where the pottery chisel was found. Although F55 is the largest house at the site, it is made of common construction material and does not contain any non-ceramic prestige goods. Therefore, the house may represent the residence of a potter rather than an elite family. Another possibility is that house F55 represents an abandoned structure used by households in the community for dumping vessels after use. This pattern of deposition is seen at Jomon sites in Japan (Kobayashi 1974:166).

I examined other archaeological reports for evidence of ceramic production at sites. Table 29 lists evidence for production such as tools and kilns at sites by cultural region. These data suggest that production for at least some wares took place in most communities. There is relatively little information for Shandong.

Table 29. Evidence for Ceramic Production at Other Sites from the Longshan Period.

cultural region / site	kilns	anvils	other
Kexingzhuang II			
Kexingzhuang (Changan County, Shaanxi), period(s) not stated (Xu et al. 1982:21-2)	3, one in a house	--	--
Taosi			
Taosi (Xiangfen County, Shanxi) period(s) not stated (Xu et al. 1982:21-2)	3	--	--
Wangwan III			
Dahecun, Period V (near Zhengzhou city, Henan), early Longshan Period, (Museum of Zhengzhou City (1979:362)	--	1, stone, plain end	--
Niuzhai (near Zhengzhou city, Henan), no date available, earlier than Gelawang site (Cultural Relics Work Team, Bureau of Culture, Henan Province 1958:23,26)	--	--	1 rectangular pottery *paizi* "beater" ca. 11.0 cm long, function not clear

Gelawang (near Zhengzhou city, Henan), late Longshan Period, (First Cultural Relics Work Team, Bureau of Culture, Henan Province 1958:50-1)	1	--	1 rect-angular clay <u>muzhi</u> "mould" same as <u>paizi</u> above
Yanzhuang (near Zhengzhou city, Henan), late Longshan Period, (Museum of Zhengzhou City 1983: 4,5,7), one C14 date, WB79-46, 2175+/-105 B.C., (Zhang and Zhang 1986:53)	--	--	1 rect-angular pottery <u>paizi</u> ca. 13.2 cm long, like tools above
Haojiatai (Yancheng County, Henan), number and periods not reported (Renmin Ribao 1986)	XX	--	--

<u>Hougang II</u>

Taikoucun (Yongnian County, Hebei), no date available, (Cultural Relics Work Team, Bureau of Culture, Hebei Province 1962: 638,640)	1	1, pottery, plain end	--
Xiapanwang (Cixian County, Hebei), (Department of Cultural Relics, Hebei Province 1975:94), one C14 date, ZK 200-1, 2515+/-145 B.C. (Zhang and Zhang 1986:52)	--	1, pottery, engraved lines on end	--

Jiangou (Handan County, Hebei), period(s) not stated, Xu et al. 1982: 21-2)	7	--	--
Balizhuang (near Anyang city, Henan), period not clear, (Xu et al 1982: 21-2), C14 date for early period ZK 756, 2585+/-145 B.C. (Zhang and Zhang 1986:52, Anyang Archaeological Team 1985:82)	1	--	--
<u>Wangyoufang</u>			
Pingliangtai (Huaiyang County, Henan), period(s) not stated, Henan Province Cultural Research Institute and the Cultural Objects Division of the Zhoukou District 1983:31)	3, in two separate areas, one in a house	--	--
<u>Chengziya</u>			
Shangzhuang (Chiping County, Shandong), late Longshan Period (Institute of Archaeology, Shandong Province 1985:484,503)	--	2, pottery, plain end	--

<u>Liangcheng</u>

Yaoguanzhuang (near Weifang city, Shandong), middle-late Longshan Period (Institute of Archaeology, Shandong Province et al. 1981: 11-2,41)	--	1, pottery, plain end	--

Significantly, at two sites, evidence for production is associated with a house. A kiln was found attached to a house at Kexingzhuang in Shaanxi, and at the walled site of Pingliangtai in eastern Henan (see Xu et al. 1982, Henan Province Cultural Research Institute and the Cultural Objects Division of the Zhoukou District 1983:31). This pattern indicates more clearly that a form of household production may characterize most communities during the Longshan Period. Feng et al. (1982:13) also hypothesize that the remains at Kexingzhuang indicate a type of specialized household production.

Scholars have remarked that kiln design improves over time from the pre-Longshan period to the Longshan Period (Song et al. 1983:269-70, Medley 1976:28, Feng et. al 1982:40-2). There is no evidence for technological changes indicative of efforts toward greater efficiency in production at any of the four sites during the Longshan Period. My observation that the kilns at Meishan do not show structural change agrees with a statement made by Li Jiazhi (1984:145) that kilns do not vary in structure during the Longshan Period.

Kilns have been found in other sites from the Longshan Period (Xu et al. 1982), as indicated in Table 30. These kilns, like those at Meishan, do not exhibit significant structural change over time. There is no evidence that potters tried to fire vessels more efficiently by increasing the size of the kiln room (<u>yao</u> <u>wu</u>), or by increasing the quantity or size of individual fire flues (<u>huo</u> <u>dao</u>). Differences in kilns among sites appear to be minor.

Table 30. Characteristics of Kilns from Other Longshan Period Sites. (derived from Table 1, Xu et al. 1982:21-2).

site	diameter of kiln room	width of main flues	quantity of main flues	branches of flues
Kexingzhuang (N=3)	1.26m, 0.96-1.33, x	x,x,x	2,x,x	4,x,x
Taosi (N=3)	1.02-1.42, x,x	0.11-0.16m, x,x	3,x,x	2,x,x
Gelawang (N=1)	x	x	x	4
Jiangou (N=7)	N=7:x	N=7:x	4 kilns have 2, N=3:x	2 kilns have 3, 1 has 4, N=4:x
Balizhuang (N=1)	x	0.06-0.1	5	x
Sanliqiao (N=1)	1.3	0.11	4	x
Miaodigou (N=1)	0.78-0.93	0.07	3	5

note:
1) "x" denotes no information for a kiln.
2) Sanliqiao and Miaodigou are located in far western Henan, Shaanxian County. There is no date for the Longshan Period remains from Sanliqiao, and the associated cultural type is debated (see Zhang and Zhang 1986).
3) Miaodigou II remains are transitional to the Longshan Period (Yan, personal communication 1987b), ZK 111 2780+/145 B.C. (Institute of Archaeology, CASS 1983:72).

Finally, data on ceramic variability from the four sites as described in Chapter 5 do not indicate significant change in degree of standardization over time for any of the shape classes examined. There is no evidence for increasing dimensional standardization. The pattern for within-class standardization in terms of secondary shape features or decorative techniques is not clear; it is possible that there is increasing standardization for a few shape classes at Hougang and Baiying. Another possible indicator of change in mode is increase in diversity in ceramic categories over time. As Chapter 5 suggests, there is a notable increase over time in number of shape classes at Lujiakou. There is a pattern of diversification for the Early to Middle Period at Baiying with regard to variety of shape classes produced. However, there are no other possible indicators for change in mode of production at either site.

Complex rather than simple household industry is the mode that most likely characterizes the majority of settlements during the Longshan Period. There is substantial ceramic variability at sites with respect to shape, size, and decoration, and some concern with efficiency is evident, from the probable extensive use of wheels and moulds. Kilns represent a substantial investment in equipment and facilitate a relatively large output. Also, a number of vessels exhibit relatively labor-intensive techniques of production.

There is evidence for technological sophistication in more than one production step such as levigation to make very fine pastes and complex firing methods. Black and grey vessels were produced by the imbibing (yin yao) method (Wu 1938:32, Zhou et al. 1982, Medley 1976:280). Medley explains that this method involves placing damp straw or other similar materials in the kiln when a critical firing temperature is reached. Then water is sprinkled on, causing a rapid decline in temperature and reduction of oxygen inside the kiln. Some black vessels from Longshan sites are uniform in color throughout the entire thickness of the walls. According to Zhou et al. (1982), this effect is caused by the penetration of carbonaceous particles into the pores of vessels.

Potters during the Longshan Period made several shape classes of vessels by assembling separately made parts. Keightley (1987) argues that this "componential construction" is technically sophisticated, however, it does not require a highly organized workshop mode of production. Measurement of different parts can be achieved by simple techniques such as wooden hoops, as Chavez (1985:46) observes in Peru. In India, potters with a complex household industry mode make cooking vessels from more than one part (Miller 1985:223-4). The ceramic data do not support the hypothesis of a workshop mode, either. My analyses suggest that there is a low degree of dimensional and within-class standardization with respect to decorative techniques over time.

Song et al. (1983:262), among others, maintain that potters used a fast wheel operated by two persons during the late Neolithic period. They discuss production methods among traditional ethnic groups in China who use a wheel in which one person turns, and the other shapes. They imply that only men, working in workshops, were potters during the Longshan Period. All lines of evidence examined in this study, however, indicate that complex household industry is more likely as the predominant mode of production than individual workshop industry.

PATTERNS OF ACCESS TO GOODS

Since the Hougang site is much larger than the other three sites and has a surrounding wall, it probably represents a center of a settlement hierarchy (Chapter 2). If Hougang was a center, it should have had a resident elite stratum who displayed their status by greater consumption of goods. In chiefdoms, centers should have a greater diversity of ceramic and other goods than subsidiary settlements (Feinman et. al 1981, Toll 1981, Costin and Earle 1989). Wares exhibiting extensive labor input and other prestige goods should be present. Only a broad comparison between sites can be made here since each site was part of a separate settlement system. Also, only two sites, Hougang and Baiying, belong to the same cultural region (Hougang II in northern Henan and southern Hebei).

However, it does not appear that the occupants of Hougang had greater access to labor-intensive vessels than the other three, non-walled sites (Chapter 5, Table 24). Similarly, with the exception of the Early (transitional) Period, Hougang does not have a greater diversity of shape classes than the other sites (Chapter 5, Table 17).

There are few nonceramic potential prestige goods at these sites. Little is known at present about status competition and use of prestige goods during the Neolithic period. On the basis of historical and archaeological data from the early dynastic period, it appears that some goods with prestige value began to have importance during the late Neolithic period. As discussed in Chapter 2, these goods include items of jade, bronze, and turquoise. There is differentiation in size and type of construction material for housing as well.

Potential prestige goods found at Hougang, Baiying, Meishan, and Lujiakou are jade items, bronze fragments, and ornaments (stone, shell, bone, horn, ceramic). Hougang does not have a greater quantity or variety of these items than the other sites (Table 31, and Appendix C, Table 74). Lujiakou has the greatest number of items (standardizing values per house, and lumping items of all materials).

There is some information on change over time in access to potential prestige goods at two sites, Baiying and Meishan. At Baiying, there may be an increase in access to goods from the Early to Middle Period. This pattern corresponds with the suggested increase in production of display vessels at the site. However, it appears there is a decline from the Middle to Late Period. There is a much greater number of houses from the Late Period at Baiying, but relatively small

Table 31. Diversity and Quantity of Nonceramic Potential Prestige Goods at Hougang, Baiying, Meishan, and Lujiakou.

site	jade	bronze	ornaments
Hougang (39 houses)	2 forms 4 items	--	7 forms 56 items
total quantity of pieces, all materials: 60/39 houses = 1.54 items per house			
Baiying			
Early (9 houses)	--	--	2 forms 14 pieces
Middle (8 houses)	--	--	2 forms 30 pieces
Late (46 houses)	2 forms 6 pieces	--	8 forms 26 pieces
total quantity of pieces, all materials: 76/63 houses = 1.21 items per house			
Meishan			
Early (17 houses)	--	--	5 forms 8 pieces
Late (16 houses)	--	traces on 2 crucibles	4 forms 8 pieces
total quantity of pieces, all materials: 18/33 houses = 0.55 items per house			
Lujiakou (11 houses)	--	--	2 forms 25 pieces
total quantity of pieces, all materials: 25/11 houses = 2.27 items per house			

quantities and kinds of items. There is no evidence of change in access to potential prestige goods at Meishan over time.

Since few goods of any kind were found in houses at these sites, a pattern of gradual site abandonment (Deal 1983, Chapter 4) may explain depositional patterns of nonceramic as well as ceramic items. Nonceramic prestige goods were found in a variety of areas (open test areas, storage pits) within each site, suggesting that they were used by a number of households rather than by only a few, elite families. Similarly, there is no indication that only a few houses at any site had access to labor-intensive vessels at any time period. These vessels were found in a variety of areas within each site. However, one unusual pot at Baiying (Late Period), the quanzupan pedestalled dish with painted human figures, was found in a house. The occupants of this house could have had high ritual status. However, the house is not large and was not built with costly materials.

A similar pattern is observable with respect to utilitarian artifacts at sites (Table 32; and Appendix C, Table 75). There is no indication that the occupants of Hougang had access to a greater diversity and quantity of utilitarian goods than people at the other sites. Again, Lujiakou has higher values (standardized per house) than the other sites. The data also suggest that there was an increase in quantity and variety of utilitarian goods at Baiying from the Early to Middle Periods, but a decrease from the Middle to Late, agreeing with the pattern for prestige goods. At Meishan as well, there appears to be

Table 32. Diversity and Quantity of Utilitarian Tools at Hougang, Baiying, Meishan, and Lujiakou.

Hougang

23 forms/39 houses= 0.59 forms per house
259 items/39 houses= 6.64 items per house

Baiying

Early Period:
14 forms/9 houses= 1.56 forms per house
49 items/9 houses= 5.44 items per house

Middle Period:
21 forms/8 houses= 2.63 forms per house
112 items/8 houses= 14.0 items per house

Late Period:
36 forms/46 houses= 0.78 forms per house
235 items/46 houses= 5.11 items per house

site as a whole: 71 forms/63 houses= 1.13 forms per house
396 pieces/63 houses= 6.29 items per house

Meishan

Early Period:
12 forms/17 houses= 0.71 forms per house
29 items/16 houses= 1.71 items per house

Late Period:
21 forms/16 houses= 1.31 forms per house
60 items/16 houses= 3.75 items per house

site as a whole: 33 forms/33 houses= 1.0 forms per house
89 items/33 houses= 2.70 items per house

Lujiakou

24 forms/11 houses= 2.18 forms per house
178 items/11 houses= 16.18 items per house

an increase in general access to utilitarian goods from the Early to Late Period.

Housing

Published data are sufficient to investigate differentiation in house size and construction material at Hougang and Baiying. At Hougang, there are 39 separate circular houses. One of the houses, F12, is occupied during two phases, 3 and 4 of the Late Period. At Baiying, there are 62 circular houses, and 1 rectangular house from the Late Period. Details on housing are provided in Appendix C (Tables 76-77).

At Hougang and Baiying, there are three types of wall material that vary in costliness of construction: 1) mud or earthen (tu), 2) wattle-and-daub (mu gu duo ni), and 3) adobe (tupi). Adobe is known as a costly construction material among the Highland Maya (Blake 1988:51). As mentioned in Chapter 2, large adobe houses were probably occupied by elites at the large walled site of Pingliangtai in the Wangyoufang cultural region. Poorer households are associated with wattle-and-daub in Mexico (Blake 1988:51) and other areas.

Changes in housing at each site are evident when floor area is compared with type of construction material (Table 33). At Hougang, there is greater variation in the Late Period: adobe houses, are, on the average, larger than earthen or wattle-and-daub houses. Also, the range of variation in floor area is greater during this period. Thus, there

Table 33. Variation in Average Size (Floor Area) of Houses by Different Types of Construction Material at Hougang and Baiying.

SITE	EARTHEN	WATTLE-AND-DAUB	ADOBE
<u>Hougang</u>			
Early	10.17 m2	--	--
Middle	17.02	15.89	15.70
Late	14.36	16.60	23.07
<u>Baiying</u>			
Early	21.08	11.64	--
Middle	12.12	9.72	--
Late	12.17	11.25	15.89

is increasing differentiation in housing over time. The same pattern is evident at Baiying. Adobe houses do not appear until the Late Period, and they are the largest in size, on the average. In contrast to the pattern for ceramic and nonceramic items, the adobe houses at Hougang provide some indication of a center of settlement. There is a greater quantity of these houses than at Baiying, and average floor area is larger. Thus it appears that status differences were symbolized more overtly in housing than in prestige or utilitarian artifacts at these sites.

There are other indications for increasing differentiation in housing at Hougang and Baiying over time. At each site, a qualitatively different type of house appears in the Late Period: one house with planked flooring at Hougang, and one rectangular house at Baiying.

Burial sites from Shandong also provide information on differential access to goods during the Longshan Period. A brief examination of two sites, Sanlihe and Chengzi, also indicates a pattern of a range of people having access to prestige items rather than just a few elites (Tables 34, 35). Labor-intensive "eggshell" tall stemmed cups are buried with individuals of both sexes and representing a range in ages. Mortuary treatment varies from site to site as well. At Chengzi, only males have the cups (Archaeological Group of the Changwei Area and the Museum of Zhucheng County 1980). At Sanlihe, both females and males have the cups (Institute of Archaeology, Shandong Province 1988).

Table 34. Characteristics of Burials with Tall Stemmed "Eggshell" Cups or gao bing bei at Chengzi (derived from Table 2, Archaeological Group of the Changwei Area and the Museum of Zhucheng County 1980:381-4).
note: () indicates total number of graves by sex in sample

age group by period	number of eggshell cups	total number of other vessel forms	wooden coffin and/or second level platform in grave
25-30			
Early (1 male)	1	2	platform and coffin
Middle (--)			
Late (--)			
30-35			
Early (--)			
Middle (1 male)	1	7	platform and coffin
Late (--)			
35-40			
Early (1 male)	1	6	platform
Middle (1 male)	1	0	both absent
Late (--)			
about 45			
Early (--)			
Middle (--)			
Late (1 male)	2	12	platform and coffin

total number of graves with eggshell cups:
Early 4/15, Middle 3/10, Late 3/6
(age and sex unknown for 5 graves, 56 graves with no pottery and unknown date, total number of graves = 87)

Table 35. Characteristics of Burials with Tall Stemmed "Eggshell" Cups or gao bing bei at Sanlihe (derived from Table 2, Institute of Archaeology, Shandong Province 1988:173-84). note: F= female, M= male, () indicates total number of graves by sex in sample, x= absent, *= present

age group by period	number of eggshell cups	total number of other vessel forms	second level platform in grave
20-30			
Early (1F)	1	0	x
Middle (1M, 1F)	M:1, F:1	M:1, F:2	M:unclear, F:x
Late (1F)	4	2	*
30-35			
Early (2M)	1,1	1,8	x,x
Middle (2M)	2,1	5,0	x,x
Late (1M)	2	5	x
40-50			
Early (1F)	1	7	*
Middle (2M, 2F)	M:3,1 F:1,1	M:10,1 F:8,8	M:x,x F:*,*
Late (1M)	1	13	*

55-60

Early			
(1M)	1	1	x
Middle			
(4F)	1,1,4,1	1,8,16,6	x,*,x,*
Late			
(0)			

total number of graves with eggshell cups:
Early 6/14, Middle 15/32, Late 5/10
(age and sex unknown for 6 graves, 42 graves with no pottery and unknown date, total number of graves= 98)

As Pearson (1988:13-4) points out, status differentiation is not the only social dimension expressed in mortuary ritual. Only some of the graves with eggshell cups at Chengzi and Sanlihe have other potential indicators of high status or wealth such as second level platforms (ercengtai), jade items, or a high diversity of vessel forms. At both sites, however, older individuals tend to have the cups. The association of age and rank known from the early dynastic period and symbolized by use of vessels (Cooper 1982) may have begun in the late Neolithic period.

Individual families may have decided how much they wanted to invest in the funerals of deceased relatives, depending upon their social ambition (see Orme 1981:234-5, Trinkhaus 1984). Burial of labor-intensive pots creates a condition of scarcity and ensures that high value is maintained (Arnold 1985:162-3). As Keightley (1985b) suggests, these cups and others may have been used by mourners at funerals before burial.

CONCLUSIONS

This chapter has examined two separate topics, mode of production and access to goods. The first section examined three categories of data in order to infer whether there is evidence for change in mode of ceramic production during the Longshan Period. It described test implications involving direct evidence for production, technology, and ceramic products. The data suggest that there was no change in mode over time at any site. This pattern is incongruent with the prediction in the model that organization of labor becomes more complex as sociopolitical complexity increases. I suggest that the complex household industry mode is more probable than a workshop mode, contrary to the proposition made by other researchers.

The second section of the chapter examined inter-site and intra-site variation with respect to artifacts and housing. The large walled site of Hougang is not markedly different from the other sites in terms of quantity and diversity of artifacts, an unexpected result for a probable center of settlement. However, a comparison of Hougang with contemporary sites in the same settlement system may indicate that the occupants had access to a greater quantity and variety of goods. At all four sites, potential prestige goods were found in a number of areas, in each period. It is likely that a number of households in each period had access to these goods.

There is information on change over time in access to artifacts at Baiying and Meishan. There is some indication that there was an increase over time in access to potential prestige goods and utilitarian goods from the Early to Middle Period at Baiying. For Meishan, there is only an increase over time in quantity and variety of utilitarian goods. There is evidence for increasing differentiation over time at Hougang and Baiying in terms of house floor area and costliness of construction material. This pattern suggests that there is increasing social differentiation as symbolized in housing at these two sites.

Finally, the analyses on intra-site variation illustrate the importance of considering site formation processes and excavation strategies when making interpretations about access to craft goods. Researchers should consider that site formation processes may vary for different categories of material culture. Smith (1987:313) maintains that serving vessels constitute the most reliable archaeological indicator of household wealth without adequately considering how processes of deposition and site abandonment. Few vessels or artifacts of any kind were recovered from houses at Hougang, Baiying, Meishan, and Lujiakou. More information on patterns of deposition of goods at Neolithic sites is necessary. Some disposal patterns may represent patterns of consumption such as status competition, but others may not such as dumping vessels in abandoned houses at Jomon sites in Japan (Kobayashi 1974). A factor relevant to Longshan sites is that because sherds are not always used for reconstruction of vessels, often they are not described in reports.

CHAPTER 7. CONCLUSIONS

INTRODUCTION

The general goal of this study was to address how craft production changes in relation to increasing cultural complexity. The study examines how systems of pottery production may change in relation to evolving chiefdoms. A revised version of the important model outlined by Rice (1981) is presented and tested with ceramic data from Longshan sites located in the Huanghe or Yellow River valley of northern China. The specific goal of the dissertation was to address the question: "How do systems of pottery production change during the Longshan Period?"

My model, after Rice (1981), makes the hypothesis that there should be an increase in diversity of ceramic categories as sociopolitical complexity increases. Also, there should be evidence for increasing standardization of shape classes and change in mode of ceramic production. However, the model focuses on describing changes in production that may take place in complex chiefdoms as well as social factors that may cause different types of ceramic change.

On the basis of later publications by Rice (1984, 1987) and ethnographic data, the model describes three alternative strategies of ceramic producers and consumers: diversification, simplification, and conservatism. It outlines how production of two categories of vessels, labor-intensive or hypothesized prestige vessels and non-prestige vessels, may change. For example, increasing population size and density may cause potters to adopt a strategy of simplification, to produce certain classes of non-prestige vessels more efficiently. In this type of social context, potters may also decide to produce a greater diversity of wares in response to increasingly varied consumer demand (Rice 1984). The model also explains how consumer demand for labor-intensive vessels for use in public displays of status can cause ceramic change. This part of the model is my own compilation and interpretation of ethnographic sources describing use of containers in ranked societies. On the basis of these data, two types of social displays with pottery should have been common in prehistoric chiefdoms, largesse and conspicuous consumption (Chapter 3). The rest of the model synthesizes observations and hypotheses made by others about change in ceramic production.

Ceramic data from four sites with relatively clear dating of phases and complete site reports were used to test the model. These sites are Hougang (northern Henan), Baiying (northern Henan), Meishan (west-central Henan), and Lujiakou (eastern Shandong). Data on ceramic variability from whole and reconstructed vessels were collected from archaeological work stations and museums in Henan and Shandong provinces during a period of six months in 1987. Professor Yan Wenming of Beijing University provided invaluable information and advice.

The following analyses were conducted in order to test the model: diversity of shape classes over time, dimensional standardization, within-class standardization, and identification of labor-intensive vessels (Chapter 5). In addition, data on ceramic variability, tools for production, and ceramic technology were assessed for the analysis of change in mode of production (Chapter 6). The interpretations made in this study should be regarded as hypotheses that can guide future research rather than firm conclusions, since small samples of vessels were used in the analyses. The assessment of variety of shape classes produced over time provides the most reliable results, since most of the excavated vessels are included in the tabulations. Other analyses must rely upon a sample of the excavated vessels (Chapter 4). Sample size is particularly a problem for the analysis of within-class standardization. Two topics are discussed in more detail below: 1) evaluation of the model in light of results obtained from the preliminary test and 2) assessment of cultural change during the Longshan Period.

RESULTS AND EVALUATION OF THE MODEL

The model of ceramic change is partially supported. There is a pattern of diversification for some components of the ceramic production systems represented by Hougang, Baiying, Meishan, and Lujiakou. There is evidence for diversification with respect to total number of shape classes produced from the Early to Middle Period at Baiying and from the Early to Late Period at Lujiakou. At both of these sites, the increase primarily involves open forms. A process observed by Miller (1982) in India may provide an explanation for this increase: consumers desire a variety of vessel shapes for displays of status. For Lujiakou, there is also some indication of a decrease over time in within-class standardization with regard to non-prestige wares.

There is other potential evidence for diversification in production of non-prestige wares from the Middle to Late Period at Baiying. It appears that the lei-bo engraved bowl was introduced during the Late Period. This type of bowl may have been used for processing tubers, as discussed in Chapter 4. The introduction of this form late in the occupation of the site may indicate that potters responded to consumer demand for a wider variety of vessels used for preparing food.

It is unfortunate with respect to its important position in the model that information on change in production of labor-intensive vessels is quite limited. However, reports tend to describe at least one example of each ceramic category found at sites. The data at hand suggest that there is some evidence for diversification in production of prestige wares. Very large, thin-walled, elaborately shaped, and elaborately decorated vessels have been found.

Type of display activity may have changed over time in the Hougang II and Taosi regions, as indicated by the decline in very large vessels by the late Longshan Period. Displays of largesse may have been replaced by displays of conspicuous consumption. Also, there may have been an increase in varieties of labor-intensive vessels from the Middle to Late Period at Hougang and during a roughly contemporary phase at Baiying (from the Early to Middle Period). White wares were introduced at this time, and it appears that there was an increase in degree of labor input for some vessels as well. For example, there is evidence for increasingly thin-walled vessels over time. These changes provide support for the hypothesis presented by Rice (1981) that there should be increasing varieties of status-related wares in a context of increasing cultural complexity.

For most sites more than one pattern emerged, supporting the prediction of Rice (1984) that there should be different types of changes for different components of productive systems. The pattern for diversity of shape classes over time at Hougang was simplification, and for Meishan, conservatism. Diversification characterized only one phase at Baiying. A pattern of conservatism resulted from the analysis of dimensional standardization for each site examined (Hougang, Meishan, Lujiakou). Results were variable for the analysis of within-class standardization.

There is little evidence from the four sites to support the hypothesis derived from Rice (1981) that there should be increasing standardization of vessels, particularly those that served utilitarian purposes. Although there is a pattern of simplification for the Middle to Late Period transition at Hougang with respect to within-class standardization and variety of ceramic categories produced, there is a pattern of conservatism for dimensional standardization. There is evidence for conservatism in dimensional standardization for non-prestige vessels from Meishan and Lujiakou as well. This pattern may be explained by the fact that potters and consumers often resist change in production of wares that are needed on a daily basis (Rice 1984). However, there is some indication that efficiency was a concern in production of vessels used for basic needs. For example, some vessels have decorative lines that were rapidly and incompletely applied.

Larger samples of vessels from Longshan sites could yield different results for analyses of change in within-class and dimensional standardization. Given the emphasis on reconstruction of vessels from Longshan sites, analysis of within-class standardization is potentially useful for future research. With whole vessels, different combinations of decorative techniques and areas of placement can be examined. Other analyses should incorporate a greater variety of inferred functional categories, too. Most classes of vessels with adequate sample size used in this study probably constitute vessels that served basic needs such as cooking and water storage. It is necessary to determine, for example, whether hypothesized prestige (labor-intensive) vessels become increasingly standardized over time as Rice (1981) predicts.

Also, the results from examination of standardization and diversity, direct evidence for production (tools, kilns), and ceramic technology (shaping, firing) do not support the prediction that there should be evidence for change in mode of production over time. Again, larger samples of relevant data from Longshan sites may yield different results. More information on areas of sites sampled for evidence of ceramic production is necessary. A problem encountered in any region is that there are few test implications derived from ethnographic data for identifying change in mode of production.

This study suggests that a "complex household industry" mode (my term) characterizes most communities from the Longshan Period rather than a workshop mode, the assumption of some researchers. In the future when relevant reports are published, it should be determined whether there are remains of workshops in centers of settlement. Thus more analysis is necessary to determine whether mode of ceramic production changes in a context of increasing cultural complexity. It is possible that changes in organization of labor for ceramic production do not occur until after state formation takes place in a region.

Although the results from this study should be regarded as preliminary due to small sample size and insufficient information on the extent to which samples of vessels represent the total population of excavated vessels, they suggest that the model developed by Rice (1981) and the revised version offered here may not be supported in all geographic areas. One factor that should be considered is scale of analysis, both temporal and spatial.

This dissertation refers to a large area in northern China and a relatively short time span, roughly 500 years (ca. 2500-2000 B.C.).

Rice (1981) tests her model on ceramic data from a 1000 year period and a single site in Belize. She is concerned with tracing ceramic change over four developmental stages, culminating with stratified societies. If one compares the Longshan Period as a whole with the earlier Neolithic period in northern China, it could be said that there is evidence for diversification in ceramic production over time. The analyses on a finer temporal scale described in this thesis resulted in different patterns for different phases. For example, the Early to Middle Period at Baiying is characterized by diversification in variety of shape classes, and the Middle to Late, conservatism.

Cultural differences between regions, such as northern China versus Belize, may have an impact on results from analysis of ceramic change. This factor may help explain patterns that resulted for the site of Meishan, located in the region in which it state formation probably first took place, Wangwan III in west-central Henan. A pattern of conservatism resulted from nearly every analysis for Meishan. Also, there is evidence for a decline in the production system with respect to labor-intensive wares. Polished and thin-walled vessels decrease over time. This pattern is evident at the walled site of Wangchenggang as well, according to Li Xiandeng (1983). My observations of vessels from the latest phases at the site on display at Gaocheng, Henan agree with this conclusion. The Late Period at Meishan and Period V at Wangchenggang represent a phase that is transitional to the Erlitou

Period. Thus they may represent an early phase of state formation (Chapter 2).

According to the model, there should be evidence for diversification over time for labor-intensive vessels in the Wangwan III region in conjunction with increasing cultural complexity. The model predicts that a decline in labor-intensive techniques for ceramic vessels is caused by a decline in status competition. In this case, however, status competition with containers may not have decreased in intensity. People may have decided to begin using another type of labor-intensive container during the terminal Longshan Period, bronze vessels. The Wangwan III region has the most physical evidence for a developing bronze industry during the Longshan Period (Chapter 2), whether sheet metal vessels were produced (La Plante 1988) in addition to cast vessels or not. Therefore, it is possible that different results from testing the model may be achieved, depending on whether a more prestigious and labor-intensive material for containers was introduced at any point. This was not the case in Belize.

A priority for future research should be to test other sites in the Wangwan III region. If there was indeed a decline in use of labor-intensive pottery vessels for display purposes, then it was probably a gradual one. Labor-intensive vessels are found at other Longshan sites in the Wangwan III region such as Wadian (Chapter 5). However, I suggest that elites would have competed more intensely for control over production and use of bronze vessels than pottery vessels, once the appropriate technology had been developed. Bronze vessels symbolize more labor input with respect to workers and equipment required for procurement of resources, preparation of materials for casting, and acquisition of a substantial number of skilled craftsmen in general.

Another priority in future research should be to obtain more information on variability in labor-intensive vessels. If larger samples of vessels were available, it would be possible to use the production step index developed by Feinman et al. (1981). Also, more data on uses of labor-intensive vessels for displays of status by elites and others are necessary. Sites should be examined for evidence of activities with these vessels such as displays of largesse or conspicuous consumption. The extent to which elites attempted to control production and/or distribution of labor-intensive vessels by sponsoring specialists, etc. should be explored as the relevant data from Longshan sites become available.

It is clear that there is a need for more information on function and depositional patterns for ceramic vessels from Longshan sites. Functional analysis could help identify categories of vessels that the model predicts should be important in public displays of status such as vessels for cooking, serving, and drinking alchohol. It could also identify classes of non-prestige vessels used on a daily basis by households. Increased recovery of vessels in houses can provide more information on strategies of consumers. Comparisons should be made of vessels found in houses with independent information on status of the occupants. For example, Costin and Earle (1989) compare types of ceramics found in houses and patio areas of elites with those of commoners (identified from architectural data) from sites dating to the late prehispanic period in Peru.

An important component of the model proposed by Rice (1981) that could not be assessed in this study is change in location of ceramic production areas and in exchange systems on a regional scale. Change in production and distribution of vessels within and between settlement systems should be a priority in future research. In Europe, for example, compositional analysis of sherds has identified production sites and distribution areas for different shape classes of vessels (Attas et al. 1987).

Exchange systems may have become more complex over time in northern China by involving more sites, greater distances, or greater volumes of vessels. Exchange of at least some classes of vessels must have taken place during the Longshan Period, given that a specialist mode of ceramic production was probably present. More research needs to be conducted in order to determine whether elites attempted to increase control of ceramic production and distribution in a context of increasing sociopolitical complexity. Berman (1986), for example, concludes from neutron activation analysis of more than one ceramic ware that there is no evidence for development of centralized production during the late prehistoric period on the Susiana Plain of Iran.

Another topic that should be addressed in future analyses of vessels from the Longshan Period is the impact of technological change on ceramic change. This study discusses different techniques of production that may have been used such as moulds for shaping (Chapter 6). Innovations in shaping, decorating, or firing techniques as well as discoveries of new raw materials (clays, pastes) may cause potters to change strategies of production. For example, use of certain types of clays can facilitate production of larger volumes of vessels at one time. Innovations in techniques for moulds may have the same effect on production.

CULTURAL CHANGE DURING THE LONGSHAN PERIOD

This study has emphasized a regional approach in assessing cultural change during the Longshan Period. Although there is evidence for regional diversity during the period, archaeological research has not focused on the region as a point of comparison (Chapter 2). As previously discussed, the ceramic analyses provided different results for the three regions examined in most detail: Wangwan III (represented by Meishan), Hougang II (Hougang and Baiying), and Liangcheng (Lujiakou). For example, conservatism was more evident at the westernmost site of Meishan, and diversification was more evident at the easternmost site of Lujiakou.

Hougang, Baiying, Meishan, and Lujiakou belong to the "eastern" region that Keightley (1987) characterizes as homogeneous in pottery production. Although I agree that there are similarities among sites, I suggest that the differences between sites are important and should be addressed more thoroughly in future research.

This study notes similarities in types of labor-intensive hypothesized prestige vessels across a wide region of the Huanghe (Yellow River). One example is the use of very large vessels, from Taosi in Shanxi to Hougang and Baiying in northern Henan. On a smaller scale, there are nearly identical thin-walled horn-shaped "lids" at two sites, Gelawang and Yanzhuang, in the Wangwan III region. Another example is the increase in thin-walled vessels and the introduction of white wares during roughly the same time period in the Hougang II region at Hougang (Middle to Late Period) and Baiying (Early to Middle Period).

These similarities suggest that there was considerable social interaction between regions during the Longshan Period. As Chang (1986) has pointed out, it is necessary to investigate the kinds of social interactions that must have taken place between communities. One type of interaction may have been emulation of "foreign" high status individuals, including their use of containers for display (Chapter 5). Another could have been exchange of vessels and/or their contents.

This study has also emphasized a processual approach in examining archaeological data from the Longshan Period. Future research should attempt to obtain more data on processes of change that must have been important such as increasing population size and density, warfare, and increasing social differentiation (Chapter 2).

There is limited information on how status differences were symbolized by material goods at sites such as Hougang, Baiying, Meishan, and Lujiakou (Chapter 6). There are few nonceramic potential prestige items at these sites such as jade ornaments. One reason may be that mortuary contexts were regarded as more appropriate for displays of status with craft items in general, or with respect to specific kinds of items such as jade (the cemetery at Taosi, for example). However, it should be profitable to examine variation over time in housing at habitation sites. Analysis of the relatively abundant data on housing from Hougang and Baiying indicates increasing differentiation in terms of floor area and wall construction material.

Future research should investigate status differentiation on a site and regional basis more thoroughly. Differences in terms of economic, political, and ritual status should be assessed. Also, centers and outlying communities of the same settlement system should be compared with respect to quality and quantity of goods in general. Scholars have suggested, for example, that period II at the walled site of Wangchenggang has yielded ceramic vessels of higher quality than other contemporary sites in the Wangwan III region (Sui 1988:48). This pattern may not characterize all areas, since Hougang does not appear to have higher quality vessels than other sites in the Hougang II region

(Chapter 6). There may be differences over time as individual centers of settlement expand and collapse, too.

Temporal scale of analysis may also affect conclusions reached about evidence for increasing cultural complexity in a region. If a relatively fine time scale is considered such as 100 years, there may be no indication of increasing cultural complexity. There may be evidence for some phases but not others. For example, there is evidence for development of walled settlements during the onset of the Longshan Period in west-central Henan, ca. 2500 B.C. There is no indication at present of other changes in type of settlement during the later Longshan Period (Chapter 2). More work on recognizing increases in cultural complexity with archaeological data during the Longshan Period is needed, such as increases in centralization and segregation (Flannery 1972).

It would be profitable to examine changes in production of other types of crafts during the Longshan Period in addition to pottery. There may be different patterns of change in a context of increasing cultural complexity for bronze or jade production. Bronze production, for example, may have involved specialists from the onset, due to skills and facilities needed for extraction and processing of ores. It may have been more directly affected by increases in cultural complexity than pottery production. There may have been intense competition by elites to control production and distribution of bronze items.

Finally, it is hoped that the analysis of shape classes discussed in Chapter 4 will be informative to others conducting research on Chinese Neolithic pottery. The terms used to designate shape classes should be regarded as generic and as starting points for analysis. Also, there are a variety of methods for describing vessels in reports. This study has attempted to show how methods of ceramic analysis developed in the West for classification and for other purposes such as understanding change in systems of production can be helpful in examining Chinese Neolithic vessels.

BIBLIOGRAPHY

Appadurai, Arjun

1986 Introduction: Commodities and the Politics of Value. IN The Social Life of Things, edited by Arjun Appadurai, pp. 3-63. New York: Cambridge University Press.

An Jiayuan

1986 Lei Bo Xiao Yi. (Some Notes on the Lei Bo). Kaogu 1986:4:344-347.

An Jinhuai

1983a Jinnian lai Henan Xia Shang Wenhua Kaogu de Xin Shouhuo. (Results of Recent Archaeological Research on Xia and Shang Culture in Henan). Wenwu 1983:3:1-7.

1983b Shilun Dengfeng Wangchenggang Longshan Wenhua Chengzhi yu Xiadai Yangcheng. (A Preliminary Discussion of the Longshan Culture City at Wangchenggang in Dengfeng and the Xia Period Site at Yangcheng). IN Zhongguo Kaoguxuehui Disici Nianhui Lunwenji. (A Collection of Papers from the Fourth Year of Chinese Archaeological Meetings), pp. 1-6. Beijing: Wenwu Press.

1987 personal communication, Zhengzhou, Henan; June 1987.

1989 Shilun Henan Diqu Longshan Wenhua de Shehui Xingzhi. (A Preliminary Discussion of the Nature of Society in the Henan Longshan Culture). Zhongyuan Wenwu 1989:1:20-24.

An Zhimin

1953 Taoqi. (Pottery). Wenwu Cankao Ziliao 1953:1:66-94.

1982 Gudai de Caomian Taoju. (Ancient Pottery Tools). IN Zhongguo Xinshiqi Shidai Lunji. (Essays on the Neolithic of China), edited by the Institute of Archaeology, CASS, pp.195-203. Beijing: Wenwu Press.

1988a Archaeological Research on Neolithic China. Current Anthropology 29(5):753-759.

1988b Zhongguo de Liqian Nongye. (Prehistoric Agriculture in China). Kaogu Xuebao 1988:4:369-381.

Anyang Archaeological Team, IA, Academica Sinica

1961 1958-1959 Nian Yin Hsu Fajue Jianbao. (Preliminary Report of the Excavation at Yin Hsu, Anyang 1958-1959). Kaogu 1961:2:63-76.

Anyang Archaeological Team, IA, CASS
1982 Anyang Hougang Xinshiqi Shidai Yizhi de Fajue. (Excavation of the Neolithic Site at Hougang, Anyang). Kaogu 1982:6:565-581.

1985 1979 Nian Anyang Hougang Yizhi Fajue Baogao. (Report of the Excavation at Hougang in Anyang, 1979). Kaogu Xuebao 1985:1:33-88.

1990 Anyang Dahancun Nangang Yizhi. (Excavation of the South Mound at Dahan Village, Anyang). Kaogu Xuebao 1990:1:43-68.

Archaeological Group of the Changwei Area and the Museum of Zhucheng County
1980 Shandong Zhucheng Chengzi Yizhi Fajue Baogao. (Report on the Excavation of the Chengzi Site at Zhucheng, Shandong). Kaogu Xuebao 1980:3:329-385.

Arnold, Dean
1985 Ceramic Theory and Cultural Process. New York: Cambridge University Press.

Attas, Michael, John Fossey, and Leo Yaffe
1987 An Archaeometric Study of Early Bronze Age Pottery Production and Exchange in Argolis and Korinthia (Corinthia), Greece. Journal of Field Archaeology 14:77-90.

Balfet, Helene
1965 Ethnographical Observations in North Africa and Archaeological Interpretation: The Pottery of the Maghreb. IN Ceramics and Man, edited by Frederick Matson, pp. 161-177. Chicago: Aldine.

Bankes, George
1985 The manufacture and Circulation of Paddle and Anvil Pottery on the North Coast of Peru. World Archaeology 17(2):269-277.

Barnes, Gina
1986 The Structure of Yayoi and Haji Ceramic Typologies. IN Windows on the Japanese Past: Studies in Archaeology and Prehistory, edited by Richard Pearson, G. Barnes and K. Hutterer, co-editors, pp. 449-476. Ann Arbor: Center for Japanese Studies, University of Michigan.

Beaudry, Marilyn
1984 Ceramic Production and Distribution in the Southeastern Maya Periphery. Late Classic Painted Serving Vessels. Oxford: BAR International Series 203.

Benco, Nancy
1987 The Early Medieval Pottery Industry at al-Basra, Morocco. Oxford: BAR International Series 341.

1988 Morphological Standardization: An Approach to the Study of Craft Specialization. IN A Pot for all Reasons. Ceramic Ecology Revisited, edited by Charles Kolb and Louana Lackey, pp. 57-72. Philadelphia: Laboratory of Anthropology, Temple University.

Berman, Judith
1986 Ceramic Production and the Development of Complex Polities in Late Prehistoric Southwestern Iran. Unpublished PhD Dissertation, Department of Anthropology, City University of New York.

Birmingham, Judy
1975 Traditional Potters of the Kathmandu Valley: An Ethnoarchaeological Study. Man 10(3):370-386.

Blake, Michael
1988 Household Features and Social Process in a Modern Maya Community. IN Ethnoarchaeology Among the Highland Maya of Chiapas, Mexico, edited by Thomas A. Lee, Jr. and Brian Hayden, pp. 45-60. Papers of the New World Archaeological Foundation No. 56, Provo, Utah.

Brumfiel, Elizabeth and Timothy Earle
1987 Specialization, Exchange, and Complex Societies: an Introduction. IN Specialization, Exchange, and Complex Societies, edited by Elizabeth Brumfiel and Timothy Earle, pp. 1-9. New York: Cambridge University Press.

Cai Feng
1987 personal communication, Jinan, Shandong; July, 1987.

Carneiro, Robert
1979 The Chiefdom: Precursor of the State. IN Transition to Statehood in the New World, edited by Grant Jones and Peter Kautz, pp. 37-79. New York: Cambridge University Press.

Chang, K.C.
1978 Early Chinese Civilization. Anthropological Perspectives. Cambridge: Harvard University Press.

1980 Shang Civilization. New Haven: Yale University Press.

1981 Archaeology and Chinese Historiography. World Archaeology 13(2):156-169.

1983a Sandai Archaeology and the Formation of States in Ancient China: Processual Aspects of the Origins of Chinese Civilization. IN Origins of Chinese Civilization, edited by David Keightley, pp. 495-521. Berkeley: University of California Press.

1983b Art, Myth, and Ritual. The Path to Political Authority in Ancient China. Cambridge: Harvard University Press.

1986 The Archaeology of Ancient China. Fourth Edition. Cambridge: Harvard University Press.

Chang, K.C., C.C. Lin, M. Stuiver, H.Y. Tu, M. Tsukada, R.J. Pearson, T.M. Hsu.
1969 Fengpitou, Tapenkeng, and the Prehistory of Taiwan. New Haven: Yale University Publications in Anthropology, No. 73.

Chavez, Karen
1985 Traditional Pottery of Raqch'i, Cuzco, Peru: A Preliminary Study of its Production, Distribution, and Consumption. Nawpa Pacha 22/23:161-210.

Cheng Te-k'un
1959 Archaeology in China. Volume One. Prehistoric China. Cambridge, England: W. Heffer and Sons Ltd.

The Chinese-English Dictionary
1979 The Commercial Press, Ltd. Hong Kong.

Clark, John
1986 Craft Specialization and Cultural Complexity. Manuscript in the Department of Anthropology, University of Michigan, Ann Arbor.

Cooper, Eugene
1982 The Potlatch in Ancient China: Parallels in the Sociopolitical Structure of the Ancient Chinese and the American Indians of the Northwest Coast. History of Religions 22(2):103-128.

Costin, Cathy
1986 From Chiefdom to Empire State: Ceramic Economy among the Prehispanic Wanka of Highland Peru. Unpublished PhD Dissertation, Department of Anthropology, University of California, Los Angeles.

Costin, Cathy Lynne and Timothy Earle
1989 Status Distinction and Legitimization of Power as Reflected in Changing Patterns of Consumption in Late Prehispanic Peru. American Antiquity 54(4):691-714.

CPAM of Anyang District, Henan Province
1983 Tangyin Baiying Henan Longshan Wenhua Cunluo Yizhi Fajue Baogao. (Excavation Report of the Longshan Culture Community Site Baiying, at Tangyin, Henan). Kaoguxue Jikan 1983:3:1-50.

Cultural Relics Work Team, Bureau of Culture, Hebei Province
1962 Hebei Yongnian Xian Taikoucun Yizhi Fajue Jianbao (Preliminary Report on the Excavation of the Site at Taikou Village, Yongnian County, Hebei). Kaogu 1962:12:635-640,645.

Cultural Relics Work Team, Bureau of Culture, Henan Province
1958 Zhengzhou Niuzhai Longshan Wenhua Yizhi Fajue Baogao. (Report on the Excavation of the Longshan Culture Site Niuzhai in Zhengzhou). Kaogu Xuebao 1958:4:19-26.

Dai Yingxin
1988 Shenmu Shimao Longshan Wenhua Yuqi. (Jades of the Longshan Culture Site Shimao in Shenmu County, Shaanxi). Kaogu Yu Wenwu 1988:5/6:239-250.

Davenport, William
1986 Two kinds of Value in the Eastern Solomon Islands. IN The Social Life of Things, edited by Arjun Appadurai, pp. 3-63, New York: Cambridge University Press.

David, Nicholas and Hilke Hennig
1972 The Ethnography of Pottery: A Fulani Case Seen in Archaeological Perspective. Reading, Massachusetts: Addison-Wesley Modular Publications 21.

Davis, Jack and Harriet Lewis
1985 Mechanization of Pottery Production: A Case Study from the Cycladic Islands. IN Prehistoric Production and Exchange. The Aegean and Eastern Mediterranean, edited by A. Bernard Knapp and Tamara Stech, pp. 79-92. Los Angeles: Institute of Archaeology, University of California Monograph XXV.

DeBoer, Warren
1974 Ceramic Longevity and Archaeological Interpretation: An Example from the Upper Ucayali, Peru. American Antiquity 39(2): 335-343.

1984 The Last Pottery Show: System and Sense in Ceramic Studies. IN The Many Dimensions of Pottery. Ceramics in Archaeology and Anthropology, edited by S.E. van der Leeuw and A.C. Pritchard, pp. 527-571. CINGVLA VII. Amsterdam: Institute for Pre- and Proto-history, University of Amsterdam.

DeBoer, Warren and Donald Lathrap
1979 The Making and Breaking of Shipibo-Conibo Ceramics. IN Ethnoarchaeology, edited by Carol Kramer, pp. 102-138. New York: Columbia University Press.

Deal, Michael
1983 Pottery Ethnoarchaeology Among the Tzeltal Maya. Unpublished PhD Dissertation, Department of Archaeology, Simon Fraser University, Burnaby, British Columbia, Canada.

1985 Household Pottery Disposal in the Maya Highlands: An Ethnoarchaeological Interpretation. Journal of Anthropological Archaeology 4:243-291.

1988 An Ethnoarchaeological Approach to the Identification of Maya Domestic Pottery Production. IN Ceramic Ecology Revisited, 1987: The Technology and Socioeconomics of Pottery, edited by Charles C. Kolb, Part I, pp. 111-142. Oxford: BAR International Series 436.

Department of Cultural Relics, Hebei Province
1975 Cixian Xiapanwang Yizhi Fajue Jianbao. (Preliminary Report on the Excavation of the Xiapanwang Site, Cixian County). Kaogu Xuebao 1975:1:73-116.

Dietler, Michael
1988 Driven by Drink: The Social Uses of Imported Wine and Implications for Economic and Political Change in French Iron Age Societies. Paper presented at the 53rd Annual Meeting of the Society for American Archaeology, Phoenix, Arizona, April 1988.

Douglas, Mary and Baron Isherwood
1979 The World of Goods. Towards an Anthropology of Consumption. London: Allen Lane Penguin Books Ltd.

Du Zaizhong
1982 Shilun Longshan Wenhua de "Dan Ke Tao". (A Preliminary Discussion on the "Eggshell Pottery" from the Longshan Culture). Kaogu 1982:2:176-181.

1987 personal commmunication, July 1987, Weifang City Museum, Shandong.

Earle, Timothy
1981 Comments on Rice. Current Anthropology 22(3):230-231.

1987a Chiefdoms in Archaeological and Ethnohistorical Perspective. Annual Review of Anthropology 16:279-308.

1987b Specialization and the Production of Wealth: Hawaiian Chiefdoms and the Inka Empire. IN Specialization, Exchange, and Complex Soocieties, edited by Elizabeth Brumfiel and Timothy Earle, pp. 64-75, Cambridge University Press.

Earle, Timothy and Robert Preucel
1987 Processual Archaeology and the Radical Critique. Current Anthropology 28(4):501-538.

Ericson, Jonathon, D. Read and C. Burke
1972 Research Design: The Relationships between the Primary Functions and the Physical Properties of Ceramic Vessels and their Implications for Ceramic Distributions on an Archaeological Site. Anthropology UCLA 3(2):84-95.

Ericson, Jonathon, and E.G. Stickel
1973 A Proposed Classification System for Ceramics. World Archaeology 4(3):357-367.

Fang Yang
1964 Wo Guo Niang Jiu Dang Shi Yu Longshan Wenhua. (The Making of Alchohol in our Country Begins with The Longshan Culture). Kaogu:1964:2:94-97.

Fang Yousheng
1986 Shilun Yuxi Longshan Wenhua. (A Preliminary Discussion of the Longshan Culture in Western Henan). Kaogu Yu Wenwu 1986:1:66-69.

Feinman, Gary, Stephen Kowalewski, Richard Blanton
1984 Modelling Ceramic Production and Organizational Change in the Pre-hispanic Valley of Oaxaca, Mexico. IN The Many Dimensions of Pottery, edited by S.E. van der Leeuw and A.C. Pritchard, pp. 296-333. CINGVLA VII. Amsterdam: Albert Egges Van Giffen Institute for Pre- and Proto-history.

Feinman, Gary and Jill Neitzel
1984 Too Many Types: An Overview of Sedentary Prestate Societies in the Americas. IN Advances in Archaeological Method and Theory. Volume 7, edited by Michael Schiffer, pp. 39-102. New York: Academic Press.

Feinman, Gary, Steadman Upham, and Kent Lightfoot
1981 The Production Step Measure: An Ordinal Index of Labor Input in Ceramic Manufacture. American Antiquity 46(4):871-884.

Feng Xianming, An Zhimin, An Jinhuai, Zhu Boqian, Wang Qingzheng, editing group
1982 Zhongguo Taoci Shi. (A History of Chinese Pottery and Porcelain), edited by the Chinese Silicate Industry Institute. Beijing: Wenwu Publishing House.

First Cultural Relics Work Team, Bureau of Culture, Henan Province
1958 Zhengzhou Gelawangcun Yizhi Fajue Baogao. (Report on the Excavation of the Site at Gelawang Village, Zhengzhou). Kaogu Xuebao 1958:3:41-62.

Firth, Raymond
1965 Primitive Polynesian Economy. Second Edition. London: Routledge and Kegan Paul Ltd.

Flannery, Kent
1972 The Cultural Evolution of Civilizations. Annual Review of Ecology and Systematics 3:399-426.

Foster, George
1956 Pottery-Making in Bengal. Southwestern Journal of Anthropology 12:395-405.

1965 The Sociology of Pottery: Questions and Hypotheses Arising from Contemporary Mexican Work. IN Ceramics and Man, edited by Frederick Matson, pp. 43-61. Chicago: Aldine.

Fournier, Robert
1981 Illustrated Dictionary of Pottery Form. New York: Van Nostrand Reinhold Co.

Frankenstein, Susan and M.J. Rowlands
1978 The Internal Structure and Regional Context of Early Iron Age Society in South-western Germany. Bulletin of the Institute of Archaeology 15:73-112.

Franklin, Ursula
1983 The Beginnings of Metallurgy in China: A Comparative Approach. IN The Great Bronze Age of China: A Symposium, edited by George Kuwayama, pp. 94-99. Seattle: University of Washington Press.

Friedman, Jonathon and M.J. Rowlands
1977 Notes Towards an Epigenetic Model of the Evolution of 'Civilisation'. IN The Evolution of Social Systems, edited by Jonathon Friedman and M.J. Rowlands, pp. 201-276. Pittsburgh: University of Pittsburgh Press.

Froese, Patricia
1985 Pottery Classification and Sherd Assignment. IN Decoding Prehistoric Ceramics, edited by Ben A. Nelson, pp. 229-242. Carbondale: Southern Illinois University Press.

Gao Tianlin, Zhang Daihai, and Gao Wei
1984 Longshan Wenhua Taosi Leixing de Niandai Yu Fenqi. (Chronology and Classification of the Taosi Type of Longshan Culture). Shiqian Yanjiu 1984:3:22-31.

Goldman, Irving
1970 Ancient Polynesian Society. Chicago: University of Chicago Press.

Goody, Jack
1982 Cooking, Cuisine and Class. A Study in Comparative Sociology. Cambridge: Cambridge University Press.

Gosden, Chris
1989 Debt, Production, and Prehistory. Journal of Anthropological Archaeology 8:355-387.

Gregory, C.A.
1982 Gifts and Commodities. London: Academic Press.

Guo Baojun
1981 Shang Zhou Tongqi Qun Zonghe Yanjiu. (A Comprehensive Study of the Shang and Zhou Bronze Vessel Group). Beijing: Wenwu Press.

Haas, Jonathan
1982 The Evolution of the Prehistoric State. New York: Columbia University Press.

1986 China and the New World: Comparisons and Contrasts. Paper prepared for the Conference Ancient China and Social Science Generalizations, Airlie House, Virginia, June 21-26, 1986.

Hagstrum, Melissa
1985 Measuring Prehistoric Ceramic Craft Specialization: A Test Case in the American Southwest. Journal of Field Archaeology 12(1):65-75.

1986 The Technology of Ceramic Production of Wanka and Inka Wares from the Yanamarca Valley, Peru. IN Ceramic Notes No. 3. Papers in Ceramics Analysis, edited by Prudence Rice, pp. 1-29. Gainesville: Florida State Museum, University of Florida.

1988 Ceramic Production in the Central Andes, Peru: An Archaeological and Ethnographic Comparison. IN A Pot For All Reasons. Ceramic Ecology Revisited, edited by Charles Kolb and Louana Lackey, pp. 127-145. Philadelphia: Laboratory of Anthropology, Temple University.

Hally, David
1986 The Identification of Vessel Function: A Case Study from Northwest Georgia. American Antiquity 51(2):267-295.

Han Rong
1989 Shilun Chengziya Leixing. (A Preliminary Discussion on the Chengziya Cultural Type). Kaogu Xuebao 1989:2:137-159.

Hansford, S. Howard
1954 A Glossary of Chinese Art and Archaeology. London: The China Society.

Hao Tiechuan
1983 Longshan Wenhua Luan Zang Keng Shigushen Fen Bianxi. (Identification and Analysis of the Status of the Remains from the Mixed Burial Pits of the Longshan Culture). Zhongyuan Wenwu 1983:4:39-42.

Hardy-Smith, Anne
1974 Post-Medieval Pot Shapes. A Quantitative Analysis. Science and Archaeology 11:4-15.

Hartwig, Frederick and Brian Dearing
1979 Exploratory Data Analysis. Sage University Paper Series on Quantitiative Applications in the Social Sciences, No. 16. Beverly Hills, California: Sage Publications.

Hayden, Brian and Aubrey Cannon
1983 Where the Garbage Goes: Refuse Disposal in the Maya Highlands. Journal of Anthropological Archaeology 2:117-163.

1984 The Structure of Material Systems: Ethnoarchaeology in the Maya Highlands. Society for American Archaeology Papers No. 3, Washington, D.C. .

Henan Province Cultural Research Institute and the Archaeological Section of the Museum of Chinese History
1983 Dengfeng Wangchenggang Yizhi de Fajue. (Excavation of the Wangchenggang Site at Dengfeng). Wenwu 1983:3:8-20.

Henan Province Cultural Research Institute and the Cultural Objects Division of the Zhoukou District
1983 Henan Huaiyang Pingliangtai Longshan Wenhua Chengzhi Shijue Jianbao. (Preliminary Report on the Test Excavations at the Longshan Culture City Site of Pingliangtai in Huaiyang, Henan). Wenwu 1983:3:21-36.

Henan Province Cultural Research Institute and the Department of History at Zhengzhou University, Archaeology Specialty
1983 Yuxian Wadian Yizhi Fajue Jianbao. (Preliminary Report on the Excavation of the Wadian Site, Yuxian County). Wenwu 1983:3:37-48.

Henrickson, Elizabeth and M. McDonald
1983 Ceramic Form and Function: An Ethnographic Search and An Archaeological Application. American Anthropologist 85(3):630-643.

Howard, Hilary
1981 In the Wake of Distribution: Towards an Integrated Approach to Ceramic Studies in Prehistoric Britain. IN Production and Distribution: A Ceramic Viewpoint, edited by H. Howard and E. Morris, pp. 1-30. BAR International Series 120.

Huber, Louisa F.
1983 The Relationship of the Painted Pottery and Lung-shan Cultures. IN The Origins of Chinese Civilization, edited by David Keightley, pp. 177-216. Berkeley: University of California Press.

Institute of Archaeology, CASS

1983 Zhongguo Kaoguxue Zhong Tanshisi Niandai Shuji. (Chronological Data on Radiocarbon Dates in Chinese Archaeology). Beijing: Wenwu Press.

1984 Xin Zhongguo de Kaogu Faxian He Yanjiu. (Archaeological Excavation and Research in New China). Beijing: Wenwu Press.

Institute of Archaeology, Shandong Province

1985 Chiping Shangzhuang Xinshiqi Shidai Yizhi. (The Neolithic Site of Shangzhuang at Chiping). Kaogu Xuebao 1985:4:465-505.

1988 Jiaoxian Sanlihe. (The Sanlihe Site at Jiaoxian). Beijing: Wenwu Press.

Institute of Archaeology, Shandong Province; Shandong Provincial Museum; Shandong Team, Institute of Archaeology, CASS, and Department of Culture, Changwei District, Shandong Province

1981 Shandong Yaoguanzhuang Yizhi Fajue Baogao. (Report on the Excavation of the Yaoguanzhuang Site, Shandong). Wenwu Ziliao Congkan 1981:5:1-83.

Johnson, Allen and Timothy Earle

1987 The Evolution of Human Societies. From Foraging Group to Agrarian State. Stanford, California: Stanford University Press.

Kaiser, Timothy

1984 Vinca Ceramics: Economic and Technological Aspects of Late Neolithic Pottery Production in Southeast Europe. Unpublished PhD Dissertation, Department of Anthropology, University of California, Berkeley.

Kamp, Kathryn

1987 Affluence and Image: Ethnoarchaeology in a Syrian Village. Journal of Field Archaeology 14(3):283-296.

Kaplan, Flora and David Levine

1981 Cognitive Mapping of a Folk Taxonomy of Mexican Pottery: A Multivariate Approach. American Anthropologist 83(4):868-884.

Keightley, David

1985a Pot Makers and Users in the Central Plains: Cultural Interaction in the Chinese Neolithic. paper prepared for the Annual Meeting of the American Historical Association, New York, New York, December 28, 1985.

1985b Dead but not Gone: The Role of Mortuary Practices in the Formation of Neolithic and Early Bronze Age Chinese Culture, ca. 8000 to 1000 B.C. paper prepared for the Conference, Ritual and the Social Significance of Death in Chinese Society, The Sun Space Ranch Conference Center, Oracle, Arizona, January 2-7, 1985.

1987 Archaeology and Mentality: The Making of China. Representations 18:91-128.

Kempton, Willett
1981 The Folk Classification of Ceramics. A Study of Cognitive Prototypes. New York: Academic Press.

Kobayashi, Tatsuo
1974 Behavioral Patterns Reflected in Pottery Remains - The Jomon Period. Arctic Anthropology XI Supplement:163-170.

Kramer, Carol
1985 Ceramic Ethnoarchaeology. Annual Review of Anthropology 14:77-102.

Kristiansen, Kristian
1984 Ideology and Material Culture: an Archaeological Perspective. IN Marxist Perspectives in Archaeology, edited by Matthew Spriggs, pp. 72-100. New York: Cambridge University Press.

Krotser, Paula
1974 Country Potters of Veracruz, Mexico. Technological Survivals and Culture Change. IN Ethnoarchaeology, edited by Christopher Donnan and C.W. Clewlow, Jr., pp. 131-146. Institute of Archaeology, University of California, Los Angeles, Archaeological Survey Monograph IV.

Lacovara, Peter
1985 The Ethnoarchaeology of Pottery Production in an Upper Egyptian Village. IN Ancient Technology to Modern Science. Ceramics and Civilization Volume 1, edited by W.D. Kingery, pp. 51-60. Columbus, Ohio: The American Ceramic Society, Inc.

La Plante, John
1988 Ancient Chinese Ritual Vessels. Some Observations on Technology and Style. Early China 13:247-273.

Leeuw, Sander van der
1977 Towards a Study of the Economics of Pottery Making. Ex Horreo 4:68-76.

1984 Dust to Dust: A Transformational View of the Ceramic Cycle. IN The Many Dimensions of Pottery. Ceramics in Archaeology and Anthropology, edited by S.E. van der Leeuw and A.C. Pritchard, pp. 707-778. CINGVLA VII. Institute for Pre- and Proto-history, University of Amsterdam.

Li Chi
1956 Pottery of the Yin and Pre-Yin Period: A Classified and Descriptive Account with a Corpus of All the Main Types. Archaeologica Sinica, no. 2. Hsiao-t'un: The Yin-Shang Site at Anyang, Honan. Vol. 3. Artifacts. Fasc. 1, pt. 1. Taipei: Academia Sinica, Institute of History and Philology, 1956.

1977 Anyang. Seattle: University of Washington Press.

Li Chi, editors in chief, Liang Ssu-yung, and Tung Tso-pin, editors; Fu Ssu-nien, Wu Chin-ting, Kuo Pao-chun, and Liu Yu-hsia
1956 Ch'eng-tzu-yai: The Black Pottery Culture Site at Lung-shan-chen in Li-ch'eng-hsien, Shantung Province. New Haven: Yale University Press. translated by Kenneth Starr

Li Jiafang and Gao Guangren
1979 Dianxing Longshan Wenhua de Laiyuan, Fazhan ji Shehui Xingzhi Chutan. (Preliminary Research on the Origin, Development and Nature of Society of Longshan Culture). Wenwu 1979:11:56-62. translated Chui-mei Ho, IN Chinese Archaeological Abstracts, 2. Prehistoric to Western Zhou. Monumenta Archaeologica 9, edited by Albert Dien, Jeffrey Riegel, and Nancy Price, pp. 191-197, Los Angeles: The Institute of Archaeology, University of California, Los Angeles.

Li Jianmin
1984 Dawenkou Muzang Chutude Jiuqi. (Wine Vessels Excavated from the Dawenkou Burials). Kaogu Yu Wenwu 1984:6:64-68.

Li Jiazhi
1984 The Evolution of Chinese Pottery and Porcelain Technology. IN Ancient Technology to Modern Science. Ceramics and Civilization. Volume 1, edited by W.D. Kingery, pp. 135-162. Columbus, Ohio: American Ceramic Society.

Li Kuang-chou
1981 K'en-ting: An Archaeological Natural Laboratory near Southern Tip of Taiwan. unpublished PhD Dissertation, Department of Anthropology, State University of New York, Binghampton.

Li Xiandeng
1983 Dengfeng Gaocheng Wangchenggang Yizhi de Chubu Fenxi. (A Preliminary Analysis of the Wangchenggang Site, Dengfeng, Gaocheng). IN Zhongguo Kaoguxuehui Disici Nianhui Lunwenji (A Collection of Papers from the Fourth Year of Chinese Archaeological Meetings), edited by the Chinese Archaeology Editing Group, pp. 7-12. Beijing: Wenwu Press.

Li Xueqin
1980 The Wonder of Chinese Bronzes. Beijing: Foreign Languages Press.

Li Yangsong
1959 Cong Wazu Zhitao Tantao Gudai Taoqi Zhizuoshangde Jige Wenti. (Some Problems of Ancient Pottery Making as Seen from an Inquiry of Pottery Manufacture among the Wa Nationality). Kaogu 1959:5:250-254.

1962 Dui Woguo Niangjiu Qiyuan de Tantao. (An Investigation Regarding the Origins of Wine Making in Our Country). Kaogu 1962:1:41-44.

Li Zhiyan and Cheng Wen
1984 Chinese Pottery and Porcelain. Beijing: Foreign Languages Press.

Lischka, Joseph
1978 A Functional Analysis of Middle Classic Ceramics at Kaminaljuyu. IN The Ceramics of Kaminaljuyu, Guatemala, edited by Ronald Wetherington, pp. 223-278. University Park: The Pennsylvania State University Press.

Longacre, William
1981 Kalinga Pottery. An Ethnoarchaeological Study. IN Patterns of the Past, edited by Ian Hodder, G. Isaac, N. Hammond, pp. 49-66. Cambridge: Cambridge University Press.

1985 Pottery Use-life Among the Kalinga, Northern Luzon, the Philippines. IN Decoding Prehistoric Ceramics, edited by Ben Nelson, pp. 334-346. Carbondale: Southern Illinois University Press.

Longacre, William, K. Kvamme, and M. Kobayashi
1988 Southwestern Pottery Standardization: An Ethnoarchaeological View From the Philippines. The Kiva 53(2):101-112.

Maisels, Charles
1987 Models of Social Evolution: Trajectories from the Neolithic to the State. Man 22(2):331-359.

Malinowski, Bronislaw
1922 Argonauts of the Western Pacific. London: George Routledge and Sons, Ltd. .

Matson, R.G.
1990 personal communication, Department of Anthropology and Sociology, University of British Columbia, Vancouver, British Columbia, June 1990.

Medley, Margaret
1976 The Chinese Potter. A Practical History of Chinese Ceramics. New York: Charles Scribner's Sons.

Milanich, Jerald, Ann Cordell, Vernon Knight, Timothy Kohler, and Brenda Sigler-Lavelle.
1984 McKeithen Weeden Island. The Culture of Northern Florida, A.D. 200-900. Orlando: Academic Press.

Miller, Daniel
1982 Structures and Strategies: An Aspect of the Relationship Between Social Hierarchy and Cultural Change, IN Symbolic and Structural Archaeology, edited by Ian Hodder, pp. 89-98. New York: Cambridge University Press.

1985 Artefacts as Categories. A Study of Ceramic Variability in Central India. New York: Cambridge University Press.

Moore, Jerry
1989 Pre-Hispanic Beer in Coastal Peru. American Anthropologist 91(3):682-695.

Museum of Zhengzhou City
1979 Zhengzhou Dahecun Yizhi Fajue Baogao (Report on the Excavation of the Site at Dahe Village, Zhengzhou). Kaogu Xuebao 1979:3:301-375.

1983 Zhengzhou Yanzhuang Longshan Wenhua Yizhi Fajue Jianbao. (Preliminary Report on the Excavation of the Longshan Culture Site Yanzhuang, Zhengzhou). Zhongyuan Wenwu 1983:4:1-8.

Nelson, Ben
1981 Ethnoarchaeology and Paleodemography: A Test of Turner and Lofgren's Hypothesis. Journal of Anthropological Research 37(2):107-129.

Netting, Robert McC.
1982 Some Home Truths on Household Size and Wealth. American Behavioral Scientist 25(6):641-662.

Nicklin, Keith
1971 Stability and Innovation in Pottery Manufacture. World Archaeology 3(1):13-48,94.

Oliver, Douglas
1955 A Solomon Island Society. Kinship and Leadership Among the Siuai of Bougainville. Boston: Beacon Press.

Orme, Bryony
1981 Anthropology for Archaeologists: An Introduction. Ithaca, New York: Cornell University Press.

Pankenier, David
1985 Mozi and the Dates of Xia, Shang, and Zhou: A Research Note. Early China 9-10:175-183.

Pastron, Allen
1974 Preliminary Ethnoarchaeological Investigations Among the Tarahumara. IN Ethnoarchaeology, edited by Christopher Donnan and C.W. Clewlow, Jr., pp. 93-114. Institute of Archaeology, University of California, Los Angeles, Archaeological Survey Monograph IV.

Peacock, David
1981 Archaeology, Ethnology and Ceramic Production. IN Production and Distribution: A Ceramic Viewpoint, edited by Hilary Howard and Elaine Morris, pp. 187-194. Oxford: BAR International Series 120.

1982 Pottery in the Roman World. London: Longman Press.

Pearson, Richard
1981 Social Complexity in Chinese Coastal Neolithic Sites. Science 213(4):1078-1086.

1988 Chinese Neolithic Burial Patterns: Problems of Method and Interpretation. Early China 13:1-45.

Pearson, Richard and Anne Underhill
1987 The Chinese Neolithic: Recent Trends in Research. American Anthropologist 89(4):807-822.

Peebles, Christopher, and Susan Kus
1977 Some Archaeological Correlates of Ranked Societies. American Antiquity 42(3):421-429.

Reina, Reuben and Robert Hill
1978 The Traditional Pottery of Guatemala. Austin: University of Texas Press.

Ren Mei'e, Yang Renzhang, and Bao Haosheng
1985 An Outline of China's Physical Geography. Beijing: Foreign Languages Press.

Renmin Ribao (People's Daily)
1985 Shandong Faxian Siqian Nianqian de Gu Chengbao Yizhi. (Discovery of a Four Thousand Year Old Ancient Castle Site in Shandong). People's Daily January 3, 1985.

1986 Henan Fajue Chu Longshan Wenhua Yizhi. (Excavation of a Longshan Culture Site in Henan). People's Daily December 18, 1986.

Rice, Prudence
1977 Whiteware Pottery Production in the Valley of Guatemala: Specialization and Resource Utilization. Journal of Field Archaeology 4(2):221-233.

1981 Evolution of Specialized Pottery Production: A Trial Model. Current Anthropology 22(3):219-240.

1984 Change and Conservatism in Pottery-Producing Systems. IN The Many Dimensions of Pottery. Ceramics in Archaeology and Anthropology, edited by S.E. van der Leeuw and A.C. Pritchard, pp. 231-293. CINGVLA VII. Institute for Pre- and Proto-history, University of Amsterdam.

1987 Pottery Analysis. A Sourcebook. Chicago: University of Chicago Press.

1988 Specialization, Standardization, and Diversity: A Retrospective. Paper prepared for the conference Ceramic Analysis and Social Inference in American Archaeology: The Ceramic Legacy of Anna O. Shepard, October 31- November 2, 1988.

1989 Ceramic Diversity, Production, and Use. IN Quantifying Diversity in Archaeology, edited by Robert Leonard and George Jones, pp. 109-117. New York: Cambridge University Press.

1990 personal communication, April-May 1990.

Rice, Prudence, and M.E. Saffer
1982 Cluster Analysis of Mixed-Level Data: Pottery Provenience as an Example. Journal of Archaeological Science 9(4):395-409.

Richards, Audrey
1939 Land, Labour and Diet in Northern Rhodesia. An Economic Study of the Bemba Tribe. London: Oxford University Press.

Rye, Owen and Clifford Evans
1976 Traditional Pottery Techniques of Pakistan. Field and Laboratory Studies. Smithsonian Contributions to Anthropology No. 21. Washington, D.C.: Smithsonian Institution Press.

Santley, Robert, Philip Arnold, and Christopher Pool
1989 The Ceramics Production System at Matacapan, Veracruz, Mexico. Journal of Field Archaeology 16(1):107-132.

Schiffer, Michael
1976 Behavioral Archaeology. New York: Academic Press.

Second Henan Archaeological Team, IA, CASS
1982 Henan Linru Meishan Yizhi Fajue Baogao. (Excavation of the Meishan Site in Linru, Henan Province). Kaogu Xuebao 1982:4:427-476.

Shandong Archaeological Team, IA, CASS and the Art Museum of Weifang County, Shandong Province.
1985 Weixian Lujiakou Xinshiqishidai Yizhi. (The Neolithic Lujiakou Site of Wei County). Kaogu Xuebao 1985:3:313-351.

Shangraw, Clarence
1978 Origins of Chinese Ceramics. China House Gallery/China Institute in America, Inc.

Shanxi Archaeological Team, IA, CASS and the Linfen District Cultural Bureau
1983 1978-1980 Nian Shanxi Xiangfen Taosi Mudi Fajue Jianbao. (Preliminary Report of the Excavations of the Cemetery Site of Taosi in Xiangfen, Shanxi, 1978-1980.) Kaogu 1983:1:30-42.

1984 Shanxi Xiangfen Taosi Yizhi Shouci Faxian Tongqi. (Discovery of Bronze for the First Time at the Taosi Site in Xiangfen, Shanxi). Kaogu 1984:12:1069-1071.

Shennan, David
1988 Quantifying Archaeology. Edinburgh University Press.

Shennan, S.J. and J.D. Wilcock
1975 Shape and Style Variation in Central German Bell Beakers: A Computer-Assisted Study. Science and Archaeology 15:17-31.

Shepard, Anna
1976 Ceramics for the Archaeologist. Washington, D.C.: Carnegie Institution.

Siegel, Sidney, and N. John Castellan, Jr.
1988 Nonparametric Statistics for the Behavioral Sciences. Second Edition. New York: McGraw-Hill Book Company.

Sinopoli, Carla
1986 Material Patterning and Social Organization: A Study of Ceramics from Vijayanagara, South India. Unpublished PhD Dissertation, Department of Anthropology, University of Michigan.

1988 The Organization of Craft Production at Vijayanagara, South India. American Anthropologist 90(3):580-597.

Smith, Marion Floyd, Jr.
1985 Toward an Economic Interpretation of Ceramics: Relating Vessel Size and Shape to Use. IN Decoding Prehistoric Ceramics, edited by Ben Nelson, pp. 254-309. Carbondale: Southern Illinois University Press.

1988 Function from Whole Vessel Shape: A Method and an Application to Anasazi Black Mesa, Arizona. American Anthropologist 90(4):912-923.

Smith, Michael
1987 Household Possessions and Wealth in Agrarian States: Implications for Archaeology. Journal of Anthropological Archaeology 6(4):297-335.

Solheim, Wilhelm
1965 The Functions of Pottery in Southeast Asia: From the Present to the Past. IN Ceramics and Man, edited by Frederick Matson, pp. 254-273. Chicago: Aldine.

Song Zhaolin, Li Jiafang, Du Yaoxi
1983 Zhongguo Yuanshi Shihui Shi. (The History of Chinese Primitive Society). Beijing: Wenwu Publishing House.

Stark, Barbara
1985 Archaeological Identification of Pottery Production Locations: Ethnoarchaeological and Archaeological Data in Mesoamerica. IN Decoding Prehistoric Ceramics, edited by Ben Nelson, pp. 158-194. Carbondale: Southern Illinois University Press.

Steponaitis, Vincas
1981 Settlement Hierarchies and Political Complexity in Nonmarket Societies: The Formative Period in the Valley of Mexico. American Anthropologist 83:320-363.

Sui Yuren
1988 Huanghe Zhongxiayou Longshan Wenhua Chengbao Chutan. (A Preliminary Exploration of the Longshan Culture "Castles" from the Middle and Lower Reaches of the Yellow River). Zhongyuan Wenwu 1988:4:46-52.

Sullivan, Alan
1988 Prehistoric Southwestern Ceramic Manufacture: The Limitations of the Current Evidence. American Antiquity 53(1):23-35.

Sun Shuyun and Han Rubin
1985 A Preliminary Study of Early Chinese Copper and Bronze Artifacts. Early China 9/10:261-289. translated by Julia Murray.

Tian Changwu
1986 The Legends of Yao and Shun and the Origins of Chinese Civilization. paper presented at the Conference on Ancient China and Social Science Generalizations, Airlie House, Virginia, June 21-27, 1986.

Toll, H. Wolcott
1981 Ceramic Comparisons Concerning Redistribution in Chaco Canyon, New Mexico. IN Production and Distribution: A Ceramic Viewpoint, edited by Hilary Howard and Elaine Morris, pp. 83-121. Oxford: BAR International Series 120.

Tong Enzheng
1989 Youguan Wenming Qiyuan de Jige Wenti- Yi An Zhimin Xiansheng Shangque. (Several Issues Regarding the Origins of Civilization - A Discussion with Mr. An Zhimin). Kaogu 1989:1:51-59,32.

Tosi, Maurizio
1984 The Notion of Craft Specialization and its Representation in the Archaeological Record of Early States in the Turanian Basin. IN Marxist Perspectives in Archaeology, edited by Matthew Spriggs, pp. 22-52. New York: Cambridge University Press.

Tregear, T.R.
1970 Economic Geography of China. New York: American Elsevier Publishing Co., Inc.

Trinkhaus, K. Mauer
1984 Mortuary Ritual and Mortuary Remains. Current Anthropology 25(5):674-679.

Tschopik, Jr., Harry
1950 An Andean Tradition in Historical Perspective. American Antiquity 15(3):196-218.

Underhill, Anne P.
1983 A Mortuary Analysis of the Dawenkou Cemetery Site, Shandong, China. Unpublished M.A. thesis, Department of Anthropology and Sociology, University of British Columbia, Vancouver, British Columbia, Canada.

1989 Warfare During the Chinese Neolithic Period: A Review of the Evidence. IN Cultures in Conflict. Current Archaeological Perspectives, edited by Diana Tkaczuk and Brian Vivian, pp. 229-237. Calgary, Alberta: The Archaeological Association, University of Calgary.

in press, a T'ao-ssu, Wang-ch'eng-kang, P'ing-liang-t'ai, and Hou-kang: Communities at the Threshold of the Bronze Age. paper prepared for the Conference Ancient Chinese and Southeast Asian Bronze Age Cultures, Edith and Joy London Foundation Property, Kioloa, NSW, Australia, February 8-12, 1988.

in press, b Cultural Change During the Longshan Period of Northern China. paper prepared for the Circum-Pacific Prehistory Conference, August 2-6, 1989, Seattle, Washington.

Vandiver, Pamela
1988 The Implications of Variation in Ceramic Technology: The Forming of Neolithic Storage Vessels in China and the Near East. Archeomaterials 2(2):139-174.

Wang Shuming
1986 Tan Lingyanghe Yu Dazhucun Chutude Taozun "Wenzi". (A Discussion of the Characters on the Pottery Zun Unearthed from Lingyanghe at Dazhu Village). IN Collected Works Discussing Prehistoric Cultures of Shandong (Shandong Shiqian Wenhua Lunwenji), edited by the Shandong Province Archaeological Series Editorial Department, pp. 249-308. Jinan: Shandong Province Cultural Bureau.

Washburne, Chandler
1961 Primitive Drinking. A Study of the Uses and Functions of Alchohol in Preliterate Societies. New York: College and University Press Publishers.

Welch, Paul
1986 Models of Chiefdom Economy: Prehistoric Moundville as a Case Study. unpublished PhD Dissertation, Department of Anthropology, University of Michigan.

Wells, Peter
1985 Material Symbols and the Interpretation of Cultural Change. Oxford Journal of Archaeology 4(1):9-17.

Whallon, Robert
1982 Variables and Dimensions: The Critical Step in Quantitative Typology. IN Essays in Archaeological Typology, edited by Robert Whallon and James Brown, pp. 127-161. Evanston, Illinois: Center for American Archaeology Press.

Wilkinson, Leland
1988a SYSTAT: The System for Statistics. Evanston, Illinois: SYSTAT, Inc.

1988b SYGRAPH. Evanston, Illinois: SYSTAT, Inc.

Wobst, Martin
1977 Stylistic Behavior and Information Exchange. IN For the Director: Research Essays in Honor of James Griffen, edited by C.E. Cleland, pp. 317-342. Anthropological Papers No. 61. Ann Arbor: Museum of Anthropology, University of Michigan.

Woods, Ann
1985 Form, Fabric, and Function: Some Observations on the Cooking Pot in Antiquity.. IN Technology and Style. Ceramics and Civilization. Volume 2, edited by W.D. Kingery, pp. 157-172. Columbus, Ohio: The American Ceramic Society, Inc.

Wright, Henry
1977 Recent Research on the Origin of the State. Annual Review of Anthropology 6:379-397.

1978 Toward an Explanation of the Origin of the State. IN Origins of the State. The Anthropology of Political Evolution, edited by Ronald Cohen and Elman Service, pp. 49-68. Philadelphia: Institute for the Study of Human Issues.

1984 Prestate Political Formations. IN On the Evolution of Complex Societies. Essays in Honor of Harry Hoijer 1982, edited by Timothy Earle, pp. 41-77. Malibu, California: Undena Publications.

Wu Chin-ting
1938 Prehistoric Pottery in China. London: Kegan Paul, Trench, Trubner and Co., Ltd.

Wu Ruzuo and Du Zaizhong
1984 Liangcheng Leixing Fenqi Wenti Chutan. (A Preliminary Study of the Periodization of the Liangcheng Type of Longshan Culture). Kaogu Xuebao 1984:1:1-22.

Xu Hong
1989 Lue Lun Wo Guo Qianshiqi Weng Guan Zang. (A Brief Discussion of the Prehistoric Burial Urn in Our Country). Kaogu 1989:4:331-339.

Xu Yuanbang, Liu Suicheng, and Liang Xingreng
1982 Zhongguo Gudai Taoqi Yao. (Ancient Pottery Kilns from China). Kaogu Yu Wenwu 1982:5:1-30.

Yan Wenming
1981 Longshan Wenhua he Longshan Shidai. (The Longshan Culture and the Longshan Period). Wenwu 1981:6:41-48.

1982a Jiangou de Tougai Bei he Botoupi Fengsu. (Skull Cap Cups from Jiangou and the Custom of Scalping). Kaogu Yu Wenwu 1982:2:38-41.

1982b Zhongguo Daozuo Nongye de Qiyuan. (Origins of Rice Agriculture in China). Nongye Kaogu 1982:1:19-31,151.

1984 Lun Zhongguo de Tongshibingyong Shidai. (A Discussion of the Chalcolithic Period in China). Shiqian Yanjiu 1984:1:36-44,35.

1985 Kaogu Ziliao Zhengli Zhong de Biaoxingxue Yanjiu. (Research in the Study of Classifying Archaeological Data). Kaogu Yu Wenwu 1985:4:30-40.

1986 Unity and Diversity in Chinese Neolithic Culture. paper prepared for the Conference Ancient China and Social Science Generalizations, Airlie House, Virginia, June 21-26, 1986. translated by Terry Kleeman.

1987a Zhongguo Shiqian Wenhua de Tongyixing Yu Duoyangxing. (Unity and Diversity in Chinese Neolithic Culture). Wenwu 1987:3:38-50.

1987b personal communication, Beijing, March- June, 1987.

1989 The Origins of Agriculture and Animal Husbandry in China. paper prepared for the Circum-Pacific Conference, Seattle, Washington, August 2-6, 1989.

Ye Wenkuan

1989 Lei Bo Yuanliu Kao. (An Investigation of the Origin and Development of the Lei-Bo). Kaogu 1989:5:456-462.

Ye Wansong and Yu Fuwei

1984 Henan Longshan Wenhua de Shehui Jingji Jichu. (The Economic and Social Foundation of the Henan Longshan Culture). Zhongyuan Wenwu 1984:3:81-85.

Zeng Qi

1985 Wo Guo Xinshiqi Shidai de Shengchan Gongju Zongshu. (A Summary of Production Tools from the Neolithic Period in Our Country). Kaogu Yu Wenwu 1985:5:61-73.

Zhang Ji

1959 Xishuangbanna Daizu de Zhitao Jishu. (Pottery Making Techniques among the Dai People of Xishuangbanna). Kaogu 1959:9:488-490.

Zhang Xinglian

1983 A Glossary of Chinese Archaeology. Beijing: Foreign Languages Press.

Zhang Yanhuang and Zhang Daihai
1986 Zhongyuan Diqu Longshan Wenhua de Leixing he Niandai. (The Types and Ages of Longshan Culture in the Central Plain District). IN Zhongguo Kaoguxue Yanjiu. Xia Nai Xiansheng Kaogu Wushi Nianji Nian Lunwenji. (Research in Chinese Archaeology. A Collection of Essays to Commemorate 50 Years of Archaeology with Mr. Xia Nai), edited by the Editorial Committee of Archaeological Research in China, pp. 46-56. Beijing: Wenwu Press.

Zhao Liansheng
1987 personal communication, Puyang, Henan; May 1987.

Zhao Zhenxi
1989 Woguo Zhitao Lunpan de Qiyan Yi Zaoqi de Yingyong. (The Origins and Early Period of Use of Wheel Made Pottery in Our Country). Kaogu Yu Wenwu 1989:4:80-84,90.

Zhong Huanan
1987 personal communication, Jinan, Shandong; July 1987.

Zhou Ren, Zhang Fukang, Zheng Shuipu
1982 Wo Guo Huanghe Liuyu Xinshiqishidai he Yinzhou Shidai Zhi Tao Gongye de Kexue Zongjie. (Scientific Conclusions on Ceramic Manufacturing Technology during the Neolithic Period and the Yin-Zhou Periods of the Yellow River Valley of Our Country). IN Collected Works Discussing Chinese Ancient Pottery and Porcelain (Zhongguo Gu Taoci Lunwenji), edited by the Chinese Silicate Industry Institute, pp. 263-286. Beijing: Wenwu Publishing House.

Zou Heng
1987 personal communication, Beijing, April 1987.

APPENDIX A. ANALYSIS OF SHAPE CLASSES IN ARCHAEOLOGICAL REPORTS.

site reports:

Hougang (Anyang Archaeological Team, IA, CASS 1985)

Baiying (CPAM of Anyang District, Henan Province 1983)

Meishan (Second Henan Archaeological Team, IA, CASS 1982)

Lujiakou (Shandong Archaeological Team, IA, CASS and the Art Museum of Weifang County, Shandong Province 1985)

Table 36. Changes Made in Shape Classes of Vessels Identified in the Hougang Report.

change in classification	method of evaluation
1 pot moved from the large size of guan to medium size class	range of values for HT and MXD, scatterplot of HT, MXD; N=38, to identify 3 size classes; Kruskal-Wallis nonparametric significance test on the classes
1 pot moved from the small guan to the pen class	differences in appearance and range of values for MXD/HT and OD/MXD; N=5 for the new small guan class and N=3 for pen with shoulder class
subtypes (xing) A,B, of large (deep) guan jar lumped, then "unknowns"- pots not identified as to subtype- added to sample for later analyses	Mann-Whitney nonparametric test using pots identified as A or B; for OD/MXD, OD/HT, OD/ODHT, RD/HT, RD/MXD, MXD/ODHT, MXD/HT for guan A: N=5, guan B: N=6; no significant difference between subtypes A and B
subtypes A,B,C for medium-sized guan jar lumped; "unknowns" added to sample for later analyses	Kruskal-Wallis nonparametric significance test using pots identified as A, B, or C; for OD/MXD, OD/HT, OD/ODHT, RD/HT, RD/MXD, MXD/ODHT, MXD/HT; for guan A: N=5, guan B: N=5, guan C: N=3; no significant difference between subtypes
subtypes A and B for small guan jar lumped	range in values for OD/BD, MXD/HT and similarity of pots in appearance; for guan A: N=3, B: N=2
2 classes formed for pen container class, originally no subtypes	qualitative differences in appearance: one class of pots has a distinct shoulder, one does not; these differences supported by values of OD/MXD,

	original class N=5, one N=2, two N=3
1 pot from bo bowl class moved to pen class	qualitative differences in appearance; supported by values for MXD/HT, OD/MXD; pen class two with shoulder N=4
subtypes A,B,C for gang jars considered homogeneous in terms of report criteria but two other classes formed	qualitative features of pots, and range of values for OD/BD; gang A: N=3, B: N=1, C: N=2; class one= with neck; class two= no neck
entire class, N=2, of small weng jars moved to gang with neck class	range of ND/MXD values; original gang with neck class N=4
subtypes A and B of pingdipen basins lumped as no difference found between vessels; "unknowns" added to sample and no separate classes identified	Mann-Whitney nonparametric test for RD/HT, OD/HT, RD/BD, OD/BD; A: N=4, B: N=6; scatterplot with OD/HT and OD/BD, N=24; scatterplot of RD and HT, large size, N=1, medium-sized, N=23
4 original subtypes of wan bowls in report: A,B,C,D; only subtype D clearly distinct (N=2); 4 other pots distinctly different and put in 3 separate classes (three, four, five); criteria for subtypes A,B,C evaluated;	on the basis of qualitative differences in appearance; supported by values for RD/HT; Kruskal-Wallis nonparametric test for RD/BD, RD/HT; class A: N=11, B: N=8, C: N=4; no difference for RD/HT; but significant difference for RD/BD;
"unknowns" added to sample and 2 classes identified	no subclasses identified by scatterplot of RD/BD and RD/HT; range of sizes apparent from scatterplot of HT, RD

subtypes A and B of xian (yan) steamer lumped as well as "other" class	can only assess report criteria by appearance of pots; no apparent difference; A: N=4, B: N=4; "other" N=4
subtypes A and B of quanzupan pedestalled dish rejected and two new classes formed	Mann-Whitney nonparametric test for RD/HT indicates no significant difference between A and B, A: N=4, B: N=3; two new classes formed using range of values for RD/HT and appearance of pots; class one N=2, two N=5
originally no subtypes for bi grate; 2 classes formed	qualitative differences in shape; class one N=1, two N=1
originally no subtypes for bei cup class; 3 formed	qualitative differences in shape; class one N=2, two N=1, three N=1

Table 37. Original Shape Classes Accepted from the Hougang Report.

shenfupen jar, N=4, no subtypes, on basis of appearance

weng necked jar, N=5, sufficient information only for subtype A, N=5, on basis of appearance

ping small necked jar, no subtypes, N=3, from appearance

_hu_ necked jar, no subtypes, N=2, from appearance

_bu_ container, N=1, from appearance

sizumin 4 footed basin, N=3, from appearance

wan bowl subtype D, N=2, from appearance - bulge at lower body

_li_ tripod, no subtypes, N=5, from appearance

jia tripod, two subtypes accepted, 1) globular body and round base, N=5, 2) more shallow body and wider rim with flat base, N=3; from appearance

ding tripod, N=1, from appearance

gui tripod, N=4 large sherds; although none pictured in report and none personally examined, class accepted because distinct form in most sites

dou stemmed dish, two subtypes A and B accepted on basis of appearance and range of values for RD/DHT (rim diameter/dish height); subtype A N=3, subtype B N=3

zhefupen carinated basin, no subtypes, N=3, from appearance

zeng perforated jar, no subtypes, N=2, from appearance zuo stand, no subtypes, N=1, from appearance

gai lid, subtypes A,B,C,D distinctly different in appearance; A: N=6, B: N=7, C: N=1, D: N=1

Table 38. Summary of Results from Nonparametric Significance Tests for Hougang Vessels.

classes	variable	test	probability value
small, medium, large *guan* jar size classes, small: N=5, medium: N=18, large: N=15	HT	Kruskal-Wallis	0.000
large *guan* jar subtypes A and B; A: N=5, B: N=6	OD/MXD	Mann-Whitney	0.018
	OD/HT		0.584
	OD/ODHT		0.715
	RD/HT		0.855
	RD/MXD		0.018
	MXD/ODHT		0.045
	MXD/HT		0.273
medium-sized *guan* jar subtypes A,B,C; A: N=5, B: N=6, C: N=3	OD/MXD	Kruskal-Wallis	0.262
	OD/HT		0.186
	OD/ODHT		0.106
	RD/HT		0.084
	RD/MXD		0.327
	MXD/ODHT		0.028
	MXD/HT		0.025
pingdipen basin subtypes A and B, A: N=4, B: N=6	RD/HT	Mann-Whitney	0.033
	RD/BD		0.136
	OD/HT		0.033
	OD/BD		0.201
wan bowl subtypes A,B,C; A: N=11, B: N=8, C: N=4	RD/BD	Kruskal-Wallis	0.003
	RD/HT		0.142
quanzupan pedestalled dish, A: N=4, B: N=3	RD/HT (dish height)	Mann-Whitney	0.077

Table 39. Changes Made in Shape Classes of Vessels Identified in the Baiying Report.

change in classification	method of evaluation
dai liu guan, 1 jar with spout moved to pitcher class	qualitative features: spout, neck.
2 guan jars, styles I,II combined as guan class two	qualitative features: orifice is square in shape, bulge at lower body
1 guan jar grouped with other guan separated as guan class three	qualitative features: jar with long neck
2 pots originally in separate classes: "tall neck small guan" and "guan" lumped into a single class, guan four	qualitative features: necked jar on a pedestal
1 guan jar grouped with other guan separated as guan class five	qualitative features, no neck
2 guan jars from different classes and styles lumped as guan class six	qualitative features, no neck
1 guan jar grouped with other guan separated as guan class seven	qualitative features, no neck
10 guan jars from a number of different styles and paste classes lumped into guan class eight	qualitative features, guan as at Hougang scatterplot of HT, MXD indicates 2 size classes; medium (N=9), large (N=1)
1 guan jar grouped with other guan separated as guan class nine	qualitative features, no neck

1 pot identified as weng necked jar moved to guan class eight	qualitative features, similarity in shape, no neck
1 pot identified as guan moved to weng necked jar class	qualitative features, similarity to weng at Hougang, neck present
9 pingdipen basins grouped into different styles and paste classes;	similarity to basins at Hougang, and scatterplot with OD/HT, OD/BD, Mann-Whitney nonparametric test used to test groups; no subclasses identified;
2 pots separated into basin classes two and three	qualitative features
4 wan bowls separated into classes one, two, three, four	qualitative features; class one like wan at Hougang
8 jia tripods from different styles and paste classes regrouped into classes one, N=3, two, N=3, three, N=2	qualitative features
10 ding tripods of different styles and paste classes combined into one class	qualitative features, similarity in terms of body shape; style of solid legs varies
1 pot called aizugui, short legged gui, moved to other pitcher class	qualitative differences
1 pot called qufupen, curved belly pen, moved to zun class	qualitative features
3 pots called bei moved to pitcher class, 6 pots from 4 classes in report (bei cup, danerbei single handle cup, xiaobei small cup, zhitongbei straight bodied cup) regrouped into two different classes, one, N=1, and two, N=5;	qualitative features, spout present, scatterplot with RD/HT and RD/BD

1 pot from danerbei separated to class three, 1 pot from bei separated to class four; the class gaozubei kept distinct but changed name to class five	qualitative differences
18 gai lids from various styles and paste classes, regrouped into ten classes, one to ten	qualitative differences; scatterplot of RD and HT indicates 2 sizes, large N=1; medium N=16 (1 no data)

Table 40. Original Shape Classes Accepted from the Baiying Report.

daierguan, guan jar with one handle, N=1, qualitatively distinct

bo bowl, N=1, from appearance, as all other classes below

xian (yan) tripod, N=5

li tripod, N=2

gui pitcher, N=3

zeng perforated jar, N=2

bi grate, N=1

zuo stand, N=1

dou stemmed dish, N=1

quanzupan pedestalled dish, N=1

panxingqi plate-shaped vessel, N=1

pan plate, N=1

lei-bo engraved bowl, N=1

zun container, N=1

shuangfupen double belly pen, N=2; same as zhefupen, carinated basin at Hougang

Table 41. Changes Made in Shape Classes of Vessels Identified in the Meishan Report.

change in classification	method of evaluation
2 pots called xiekouguan or slanted mouth guan changed to guan class	appearance
12 pots from different classes (xiefuwan, slanted belly wan N=6; bo bowl N=4; pen container N=2) changed to wan class then evaluated for homogeneity, result is class one, N=12	appearance indicates wan class; scatterplot for 11 bowls RD/BD and RD/HT; 2 groups tested by Mann-Whitney statistic (N=5, N=6), no significant difference in terms of these ratios
two pots from slanted belly wan class changed to wan class two (cup-like), 2 pots from qufuwan or curved belly wan class changed to wan class three; a third pot from qufuwan class changed to wan class four (bulge in profile); a fourth pot from qufuwan class changed to wan class five (angular)	appearance
5 styles of kecaopen, engraved pen container, changed to two classes, one (bowl-like) N=5, and two (cup-like) N=1; change class name to lei-bo	appearance
danerbei cup with handle class split into two classes, one N=1, and two N=2	appearance
5 styles of gai lids changed to classes one (curved wall) N=3, and two (square in profile) N=3	appearance

Table 42. Original Shape Classes Accepted from the Meishan Report.

guan jars, N=6, this class and all others evaluated on basis of appearance, 2 styles lumped

yuan fu guan, round belly *guan*, N=2, accepted but called round necked jar, 2 styles lumped

da kou guan, large mouthed jar, N=2

xiao guan, small jar, N=1 (different in shape than other *guan*)

gao jing xiao guan, tall neck small jar, N=2

small *pen*, N=2; here, a wide rimmed bowl, unlike *pen* at Hougang

weng, necked jar, N=5, 5 styles lumped

shen fu weng, deep belly necked jar, N=1; different in shape than *weng* class above

xian (*yan*) tripod, N=1

jia tripod, N=1

ding tripod, N=12, 4 styles lumped

gui pitcher, N=3

he container, N=1

zeng perforated jar, N=3

bi grate, N=2

quan zu pan, pedestalled dish; two different styles from one period distinguish two different shapes, these classes called one and two, one vessel from another period with no style designation added to class two; class one N=2, class two N=3

dou stemmed dish, N=7, 2 styles lumped; all have narrow stem qu fu pen, curved belly container, N=1, same as zhe fu pen, carinated basin at Hougang

gu beaker, N=4, 4 styles lumped

zhe fu bei, bent belly cup, N=1

chu xing bei, pestle-shaped cup, N=3, 2 styles lumped

yuan fu bei, round belly cup, N=2

zun xing bei, zun shaped cup, N=1

Table 43. Changes Made in Shape Classes of Vessels Identified in the Lujiakou Report.

change in classification	method of evaluation
under one paste type report lists 3 styles of *guan* jars; 7 classes formed: one (N=3), two (N=1), three (N=2), four (N=1), five (N=2), six (N=1), seven (N=1)	appearance
report defines subtypes (*xing* A,B,C) of *pen*; A is similar to *pingdipen* basin at Hougang, 3 classes formed one (shallow, N=1), two (flaring walls, N=4), three (deep, N=1);	appearance (2 "unknown" pots added to class one, 1 to class three); appearance;
from *xing* B, 2 classes formed, class four (N=1), five (N=3);	(1 "unknown" pot added to class four);
from *xing* C, 2 classes formed, six (N=1), seven (N=2)	appearance
report lists 5 *wan* bowls in 2 styles; 13 "unknowns" added to sample; 18 pots evaluated 2 classes formed; one (N=17), two (N=1)	differences among vessels noticable from examination scatterplot of RD/BD, RD/HT shows 2 groups, scatterplot of HT,RD shows a wide range of sizes
report lists 5 subtypes for *ding* tripod of one paste type (A,B,C,D,E); pots regrouped into class one (N=3), two (N=1), three (N=1), four (N=1), five (N=1), six (N=1, an "unknown" pot)	appearance

report lists 3 subtypes for <u>ding</u> tripod of another paste type (A,B,C; N=3,3,1)	sample size permits evaluation by a scatterplot of OD/MXD and MXD/ODHT; groups not distinct
<u>yu</u> container 2 styles, changed to classes one (N=1), two (N=1)	appearance
<u>bei</u> cup class split into 4 classes, one (N=2), two (N=2), three (N=1), four (N=1)	appearance

Table 44. Original Shape Classes Accepted from the Lujiakou Report.

xing (subtype) A,B,C _guan_ jar for one type of paste accepted but called _guan_ jar classes eight (N=2), nine (N=2), ten (N=2); these classes and all others evaluated on the basis of vessel appearance

pen container _xing_ (subtype) D, but called _pen_ class eight, N=1; same as _zhe fu pen_, carinated basin at Hougang

pen container _xing_ E, but called _pen_ class nine, N=1

_hu_ necked jar, N=3

xian (yan) tripod, N=1

gui pitcher, N=3; 1 "unknown" pot added to class, too

dai liu bo, _bo_ bowl with spout, N=2

_bi_ grate, N=1

san zu pan, three footed _pan_ dish, 4 subtypes or _xing_ accepted, called class one (N=2), two (N=2), three (N=2), four (N=1)

dou stemmed dish, N=4

lei pedestalled jar, N=1

gai lid, 4 styles accepted as distinct classes, re-named as class one (N=1), two (N=2), three (N=1), four (N=1)

Table 45. Lids at Hougang for Covering Other Vessels or for Serving Food.

shape class	rim diameter	height
hypothesized function: covering other pots		
gai four, N=1	12.3 cm	no data but flat
hypothesized function: serving food; too big in rim diameter and height to cover other pots at orifice		
gai one, N=5 (one case no data)	range= 25.0-37.0 median= 28.8	range= 8.9-11.7 median= 10.0
gai two, N=7	range= 10.5-31.4 median= 16.0	range= 2.4-9.7 median= 6.5
gai three, N=1	16.7	broken
gai five, N=1	broken, greatly curved in profile	
hypothesized cooking vessels		
guan jars, large, N=15	range= 18.8-25.3 median= 20.0	
guan jars, medium, N=18	range= 10.0-17.6 median= 14.8	
jia tripod, one, N=3 (2 cases no data)	13.0, 13.0, 19.0	
two, N=3	no data	

li tripod, N=1 (4 cases no data)	16.0
xian/yan tripod, N=7 (5 cases no data)	range= 23.6-29.0 median= 25.4
ding tripod, N=1 (7 cases no data)	11.5

Table 46. Lids at Baiying for Covering Other Vessels or for Serving Food.

shape class	rim diameter	height
hypothesized function: covering other pots		
gai one, N=5 (bowl-like)	range= 12.0-15.5 cm median= 12.8	range= 4.0-7.5 median= 5.7
hypothesized function: serving food; too big in rim diameter and height to cover other pots at orifice		
gai two, N=3	range= 20.9-31.5 median= 23.0	9.0-12.9 median= 9.4
gai three, N=1	56.0	11.5
gai four, N=1	10.4	broken (5.0)
gai five, N=1	21.4	broken (8.0)
gai six, N=2	13.4, 14.4	6.0, 5.8
gai seven, N=1	14.0	4.6
gai eight, N=1	29.1	broken (11.0)
gai nine, N=1	14.0	6.0
gai ten, N=1	18.6	7.1
gai eleven, N=1	9.3	1.4

hypothesized cooking vessels	
guan jars, eight, medium, N=5	range= 16.1-23.0 median= 17.9
xian/yan tripod, N=4 (1 case no data)	range= 24.5-33.0 median= 26.6
li tripod, N=2	14.7, 23.0
jia tripod, one, N=3	range= 13.7-18.3 median= 16.3
two, N=3	range= 19.5-25.3 median= 20.0
three, N=2	15.5, 15.3
ding tripod, one, N=9	range= 11.8-19.3 median= 13.6
two, N=1	21.0
gui tripod, N=1 (3 cases no data)	8.3
zeng jar, N=2	20.0, 15.1

Table 47. Lids at Meishan for Serving Food.

shape class	rim diameter	height
hypothesized function: serving food		
lids too big in rim diameter and height to cover other pots at orifice		
gai one, N=3	range= 26.0-32.0 median= 27.0 cm	no data
gai two, N=3	range= 29.5-37.0 median= 30.0	no data
hypothesized cooking vessels		
guan jar, N=8	range= 17.4-27.0 median= 22.0	
ding tripod, N=11 (1 pot no data)	range= 10.10-23.0 median= 18.5	
jia tripod, N=1	20.0	

Table 48. Lids at Lujiakou for Covering other Vessels or for Serving Food.

shape class	rim diameter	height
hypothesized function: lids for covering other pots		
gai one, N=1	9.8	3.4
gai two, N=1	12.8	3.0
gai three, N=2	8.4, 12.0	2.7, 3.5
hypothesized function: lids for serving food: too big in rim diameter and height to cover other pots at orifice		
gai four, N=1	23.5	12.0
hypothesized cooking vessels		
xian/yan tripod, N=1	18.5	
ding tripod, seven, N=7	range= 13.0-21.5 median= 18.0	
guan jar, seven, N=2	15.7, 14.0	

Figure 5.

Guan Jar Size Classes, Hougang
(n=38)

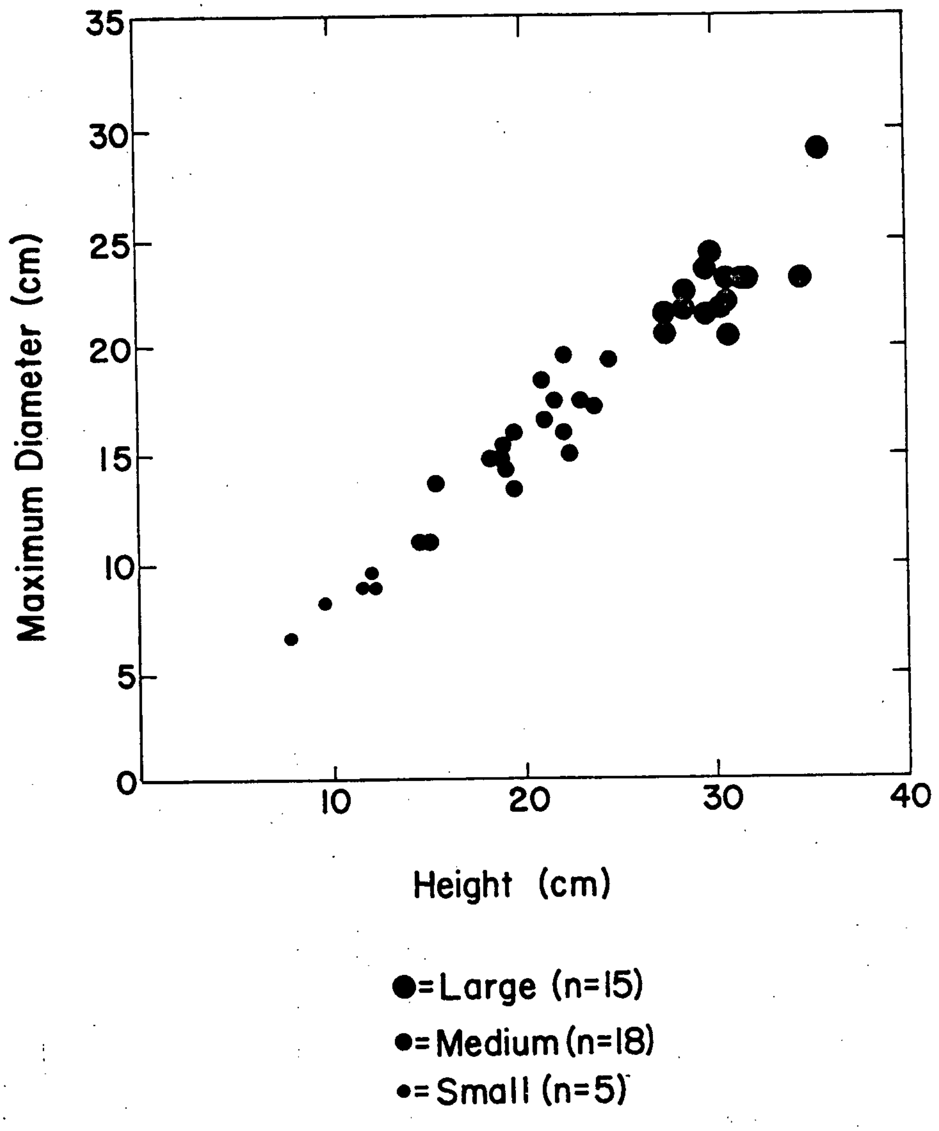


Figure 6.

Size of <u>Guan</u> Jars, Class Eight, Baiying
(n=11)

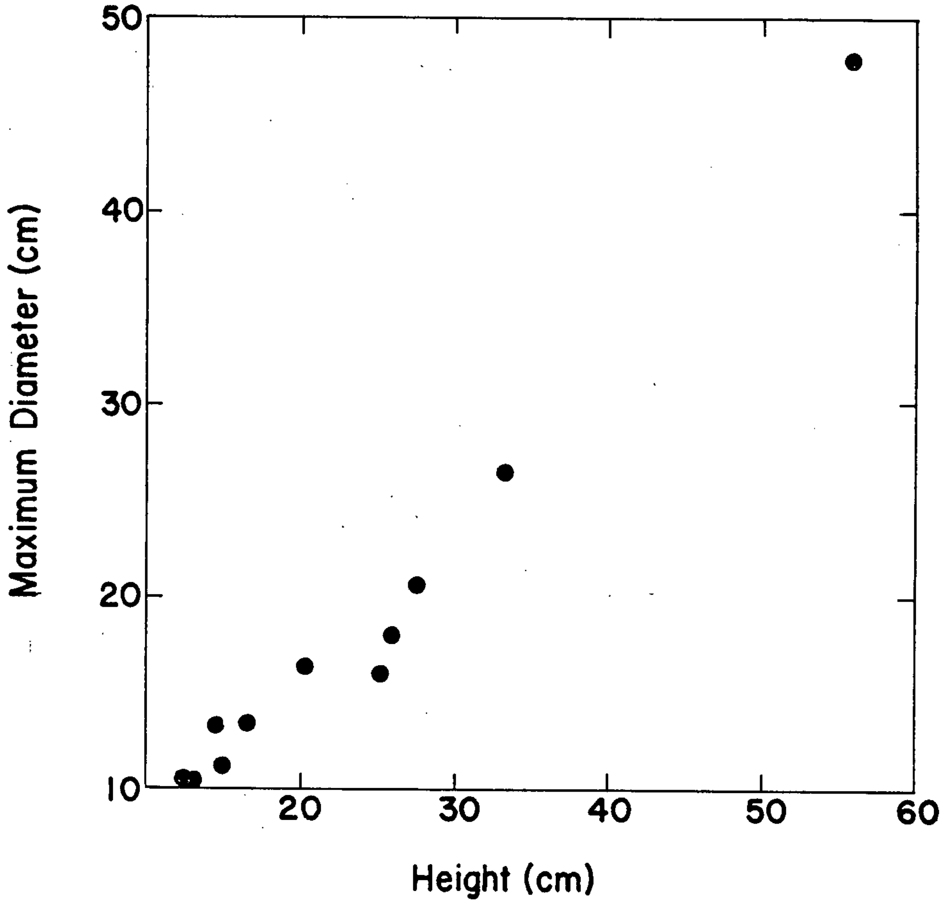
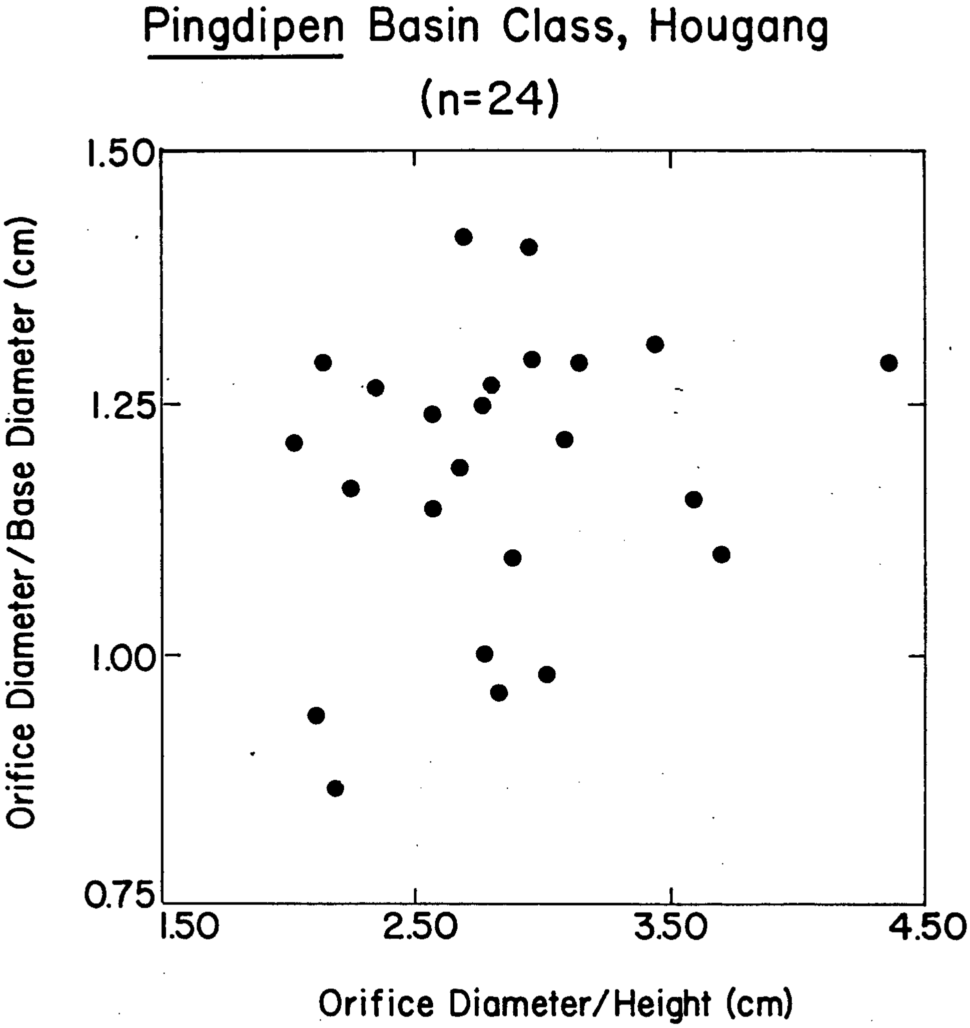


Figure 7.



Pingdipen Basin Class, Hougang
(n=24)
1.50
1.25
1.00
0.75
1.50
2.50
3.50
4.50
Orifice Diameter/Base Diameter (cm)
Orifice Diameter/Height (cm)

Figure 8.

<u>Pingdipen</u> Basin Size Classes, Hougang
(n=24)

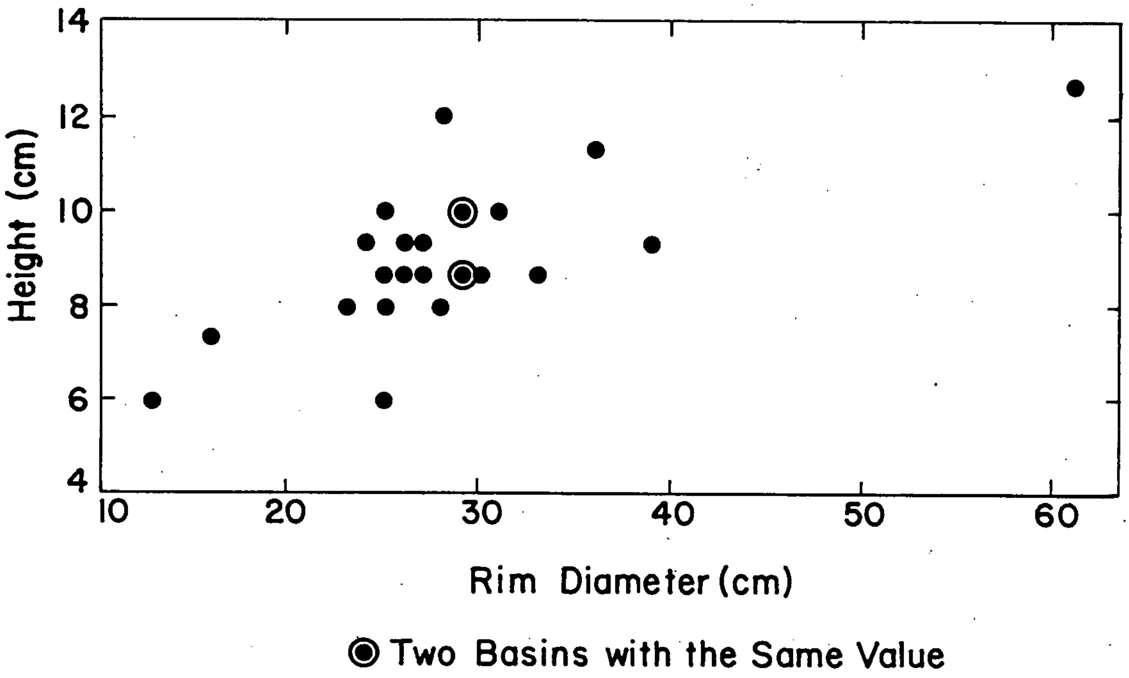


Figure 9.

<u>Pingdipen</u> Basin Class One, Baiying
(n=7)

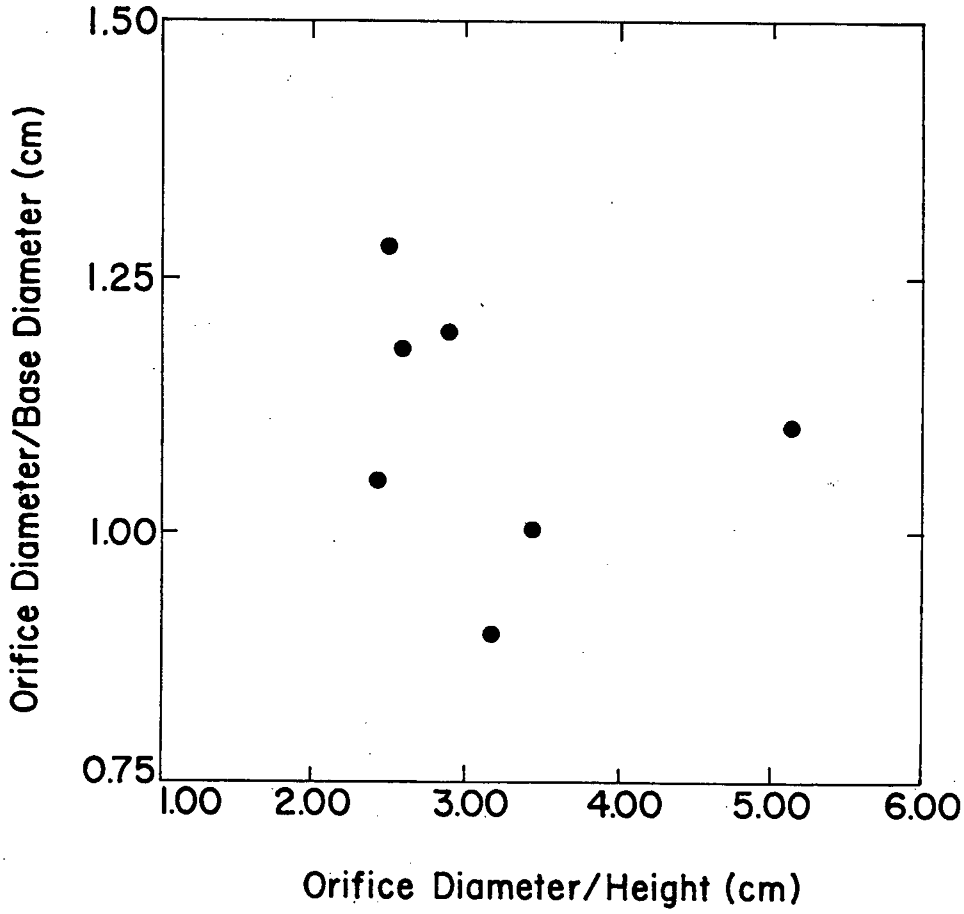


Figure 10.

Sizes of Pingdipen Basins, Class One, Baiying (n=7)

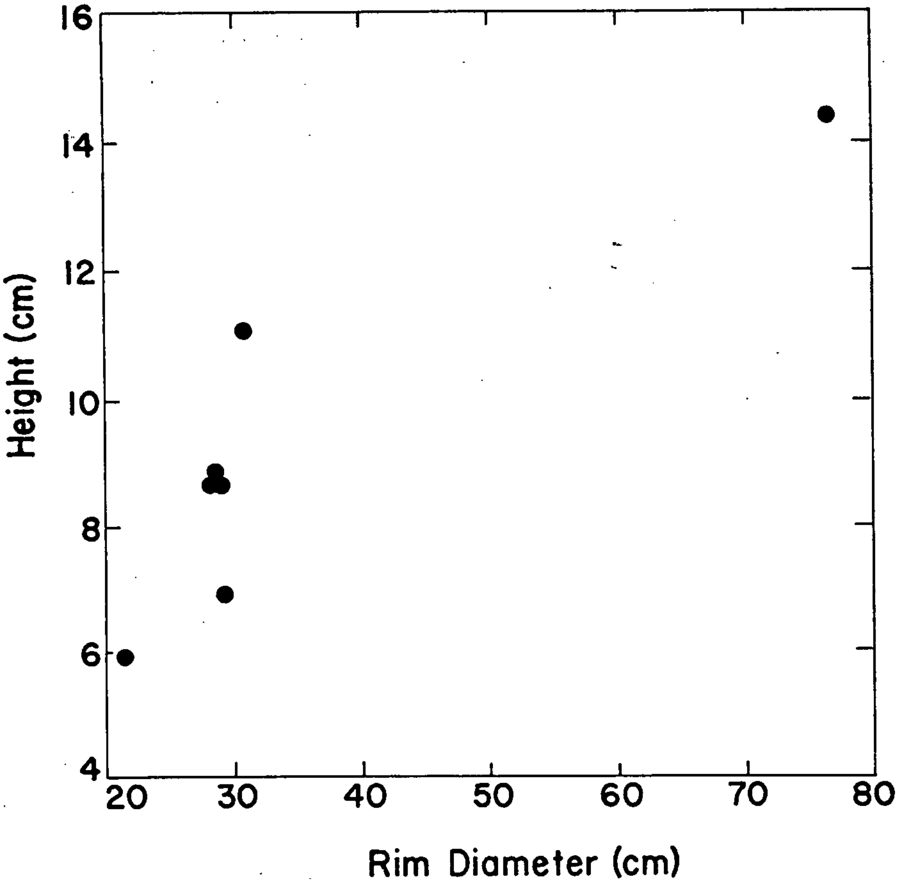


Figure II.

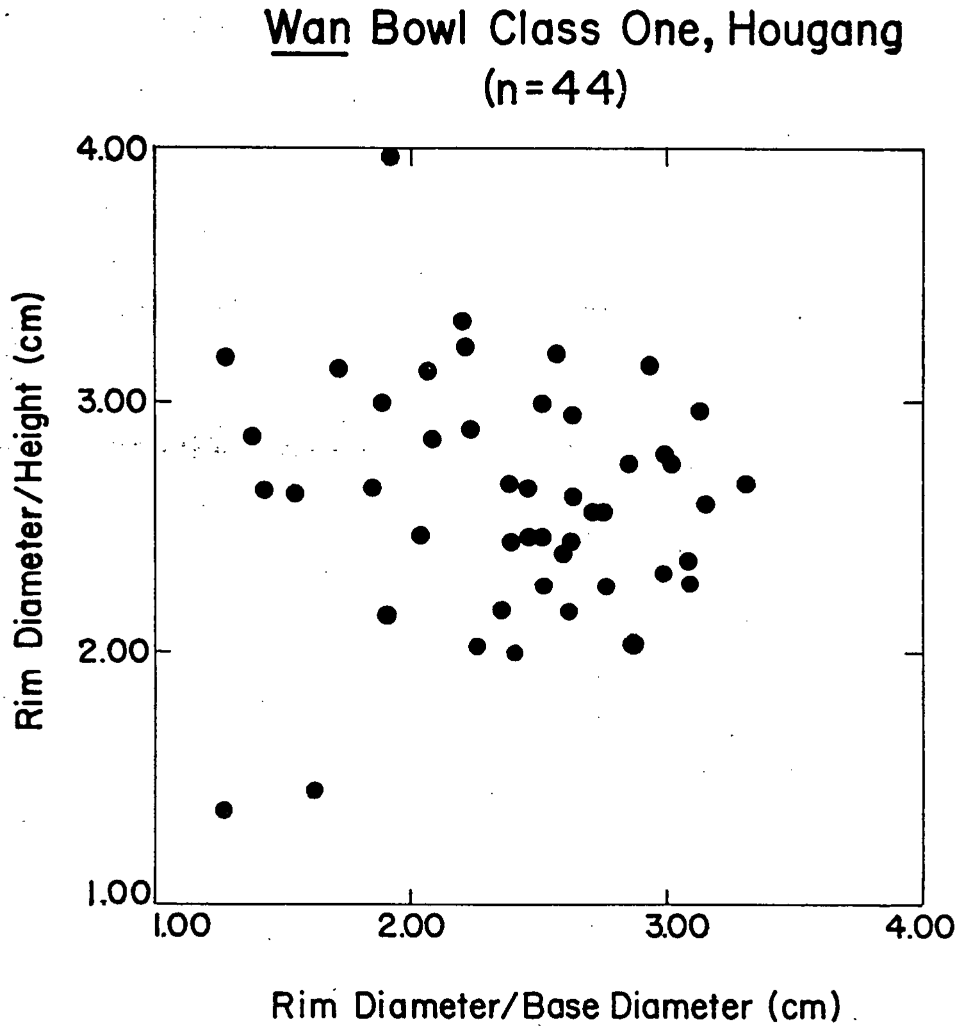

Wan Bowl Class One, Hougang
(n=44)
4.00
3.00
2.00
1.00
1.00
2.00
3.00
4.00
Rim Diameter/Height (cm)
Rim Diameter/Base Diameter (cm)

Figure 12.

Sizes of <u>Wan</u> Bowls Class One, Hougang
(n=44)

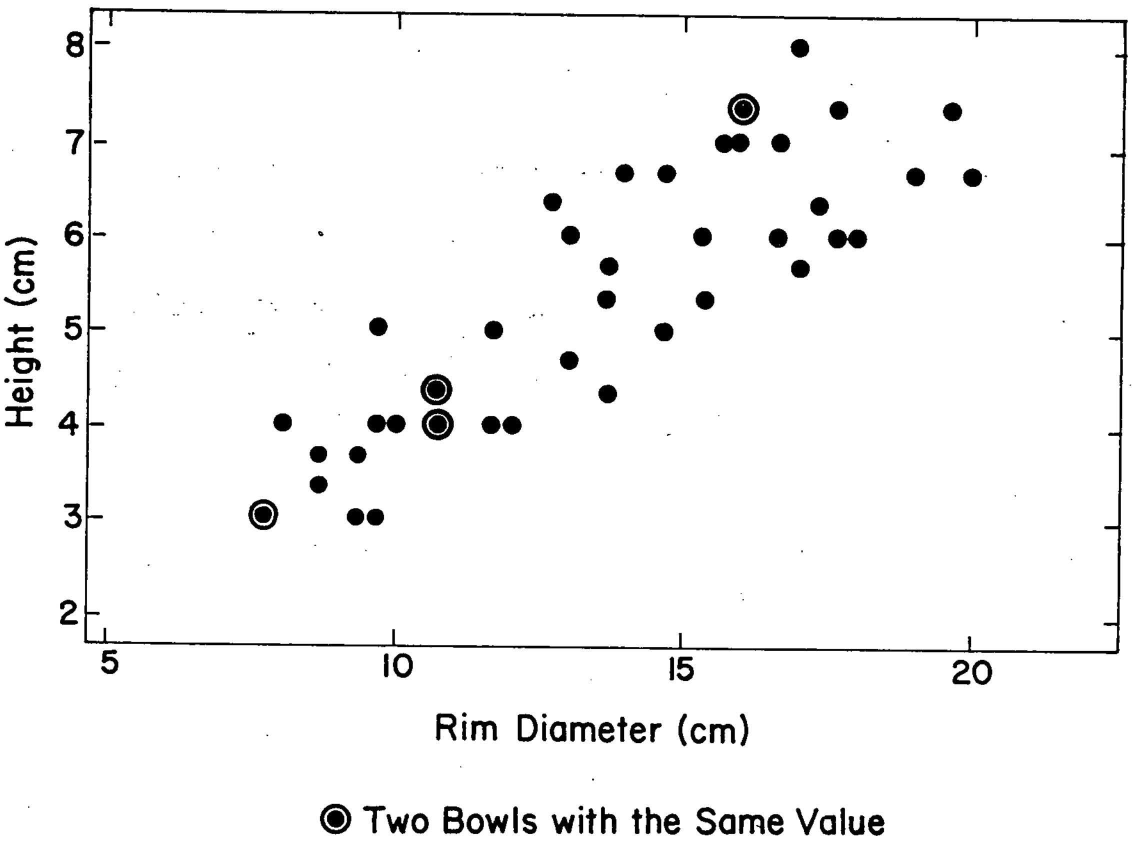


Figure 13.

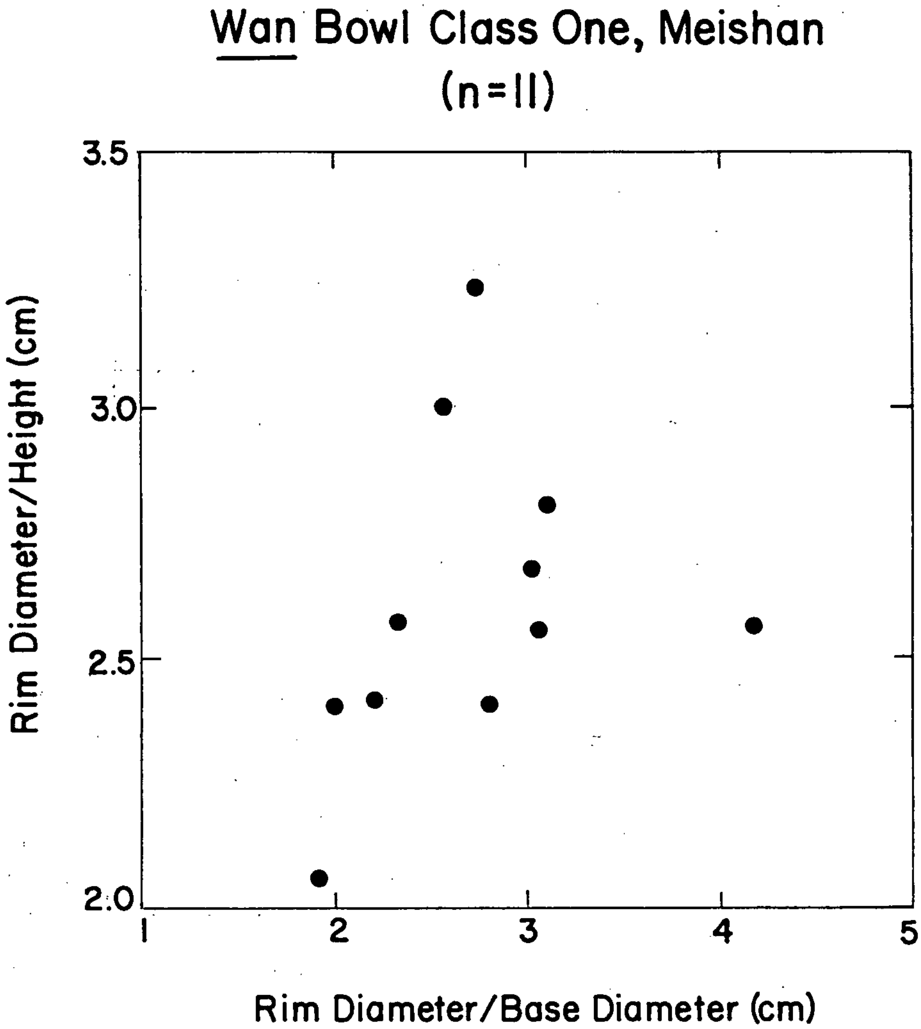

Wan Bowl Class One, Meishan
(n=11)
3.5
3.0
2.5
2.0
1
2
3
4
5
Rim Diameter/Height (cm)
Rim Diameter/Base Diameter (cm)

Figure 14.

Sizes of Wan Bowls, Class One, Meishan (n=11)

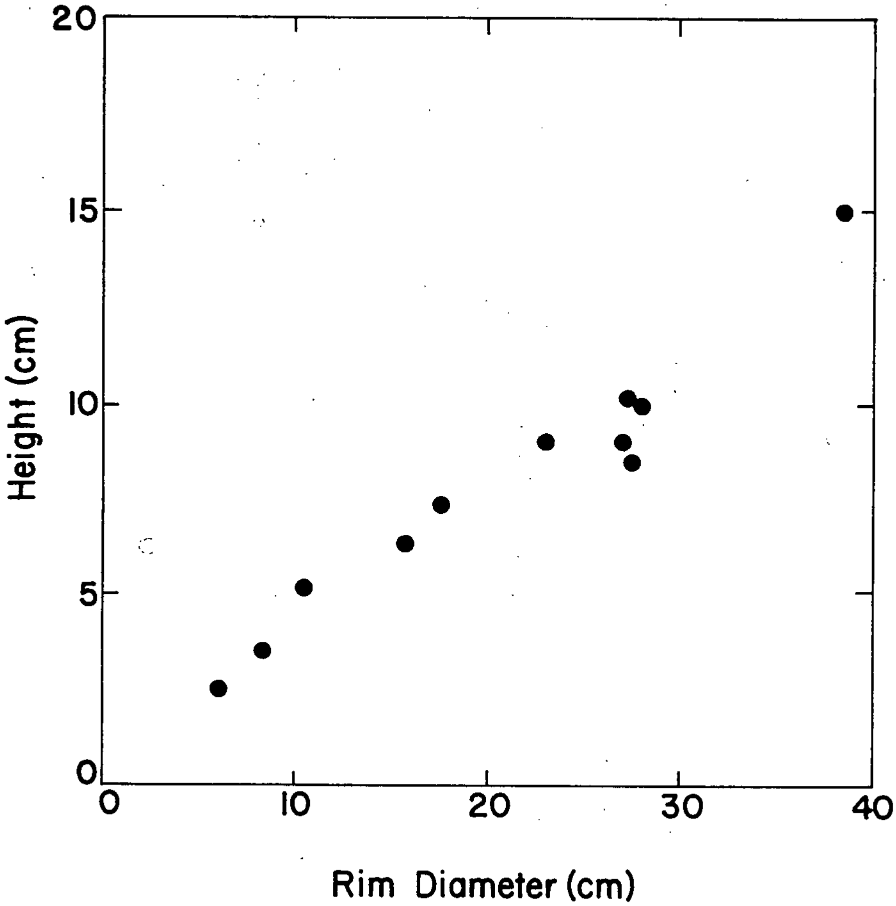


Figure 15.

Wan Bowl Classes One and Two, Lujiakou
(n=18)

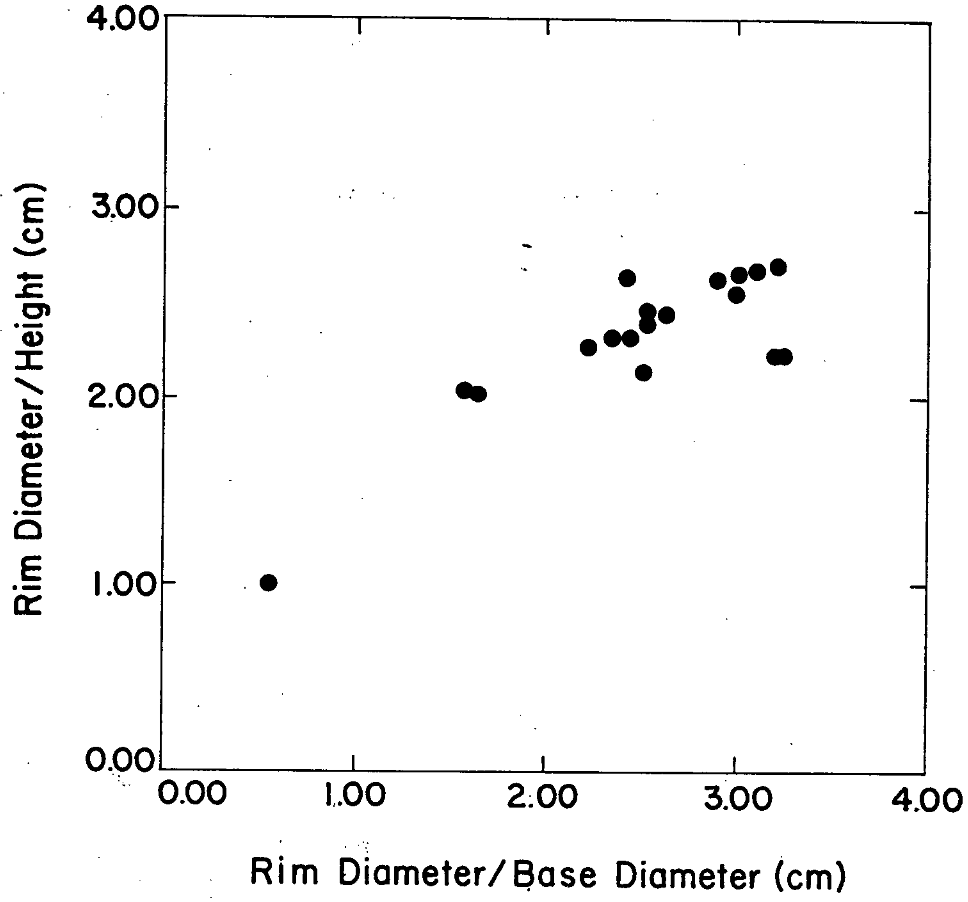


Figure 16.

Sizes of Wan Bowls Class One, Lujiakou
(n=18)

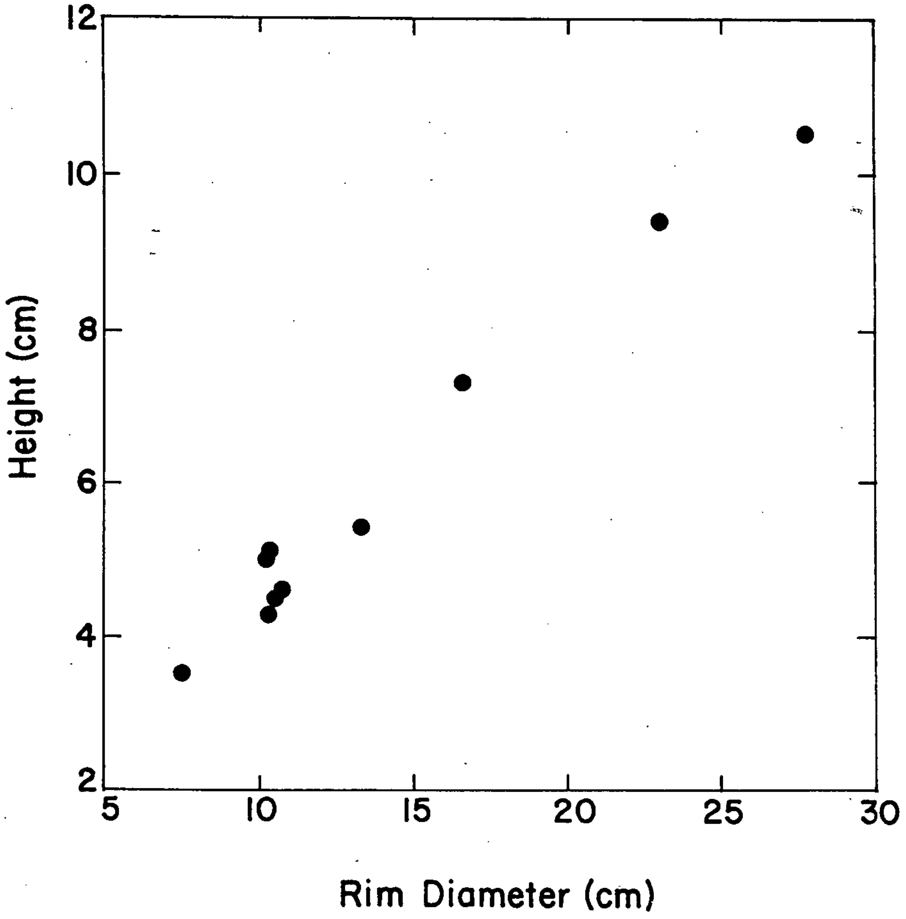


Figure 17

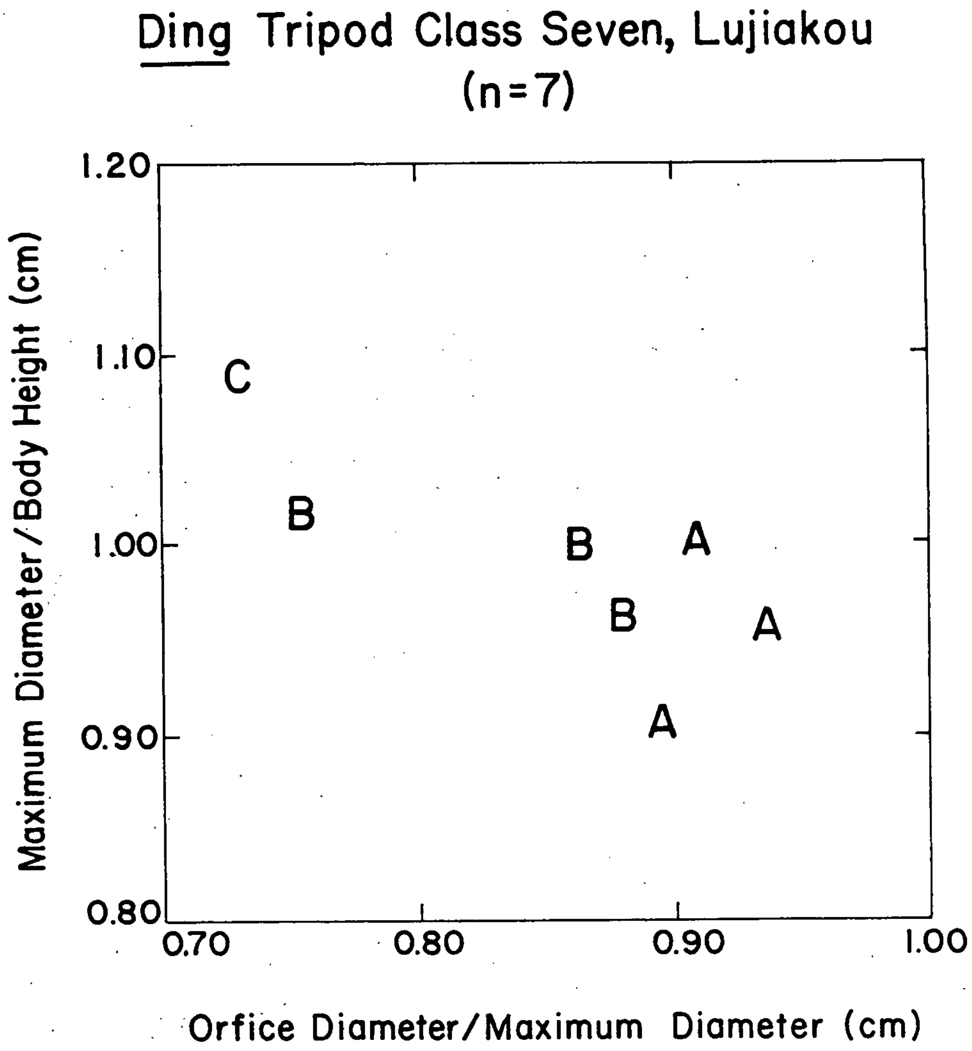
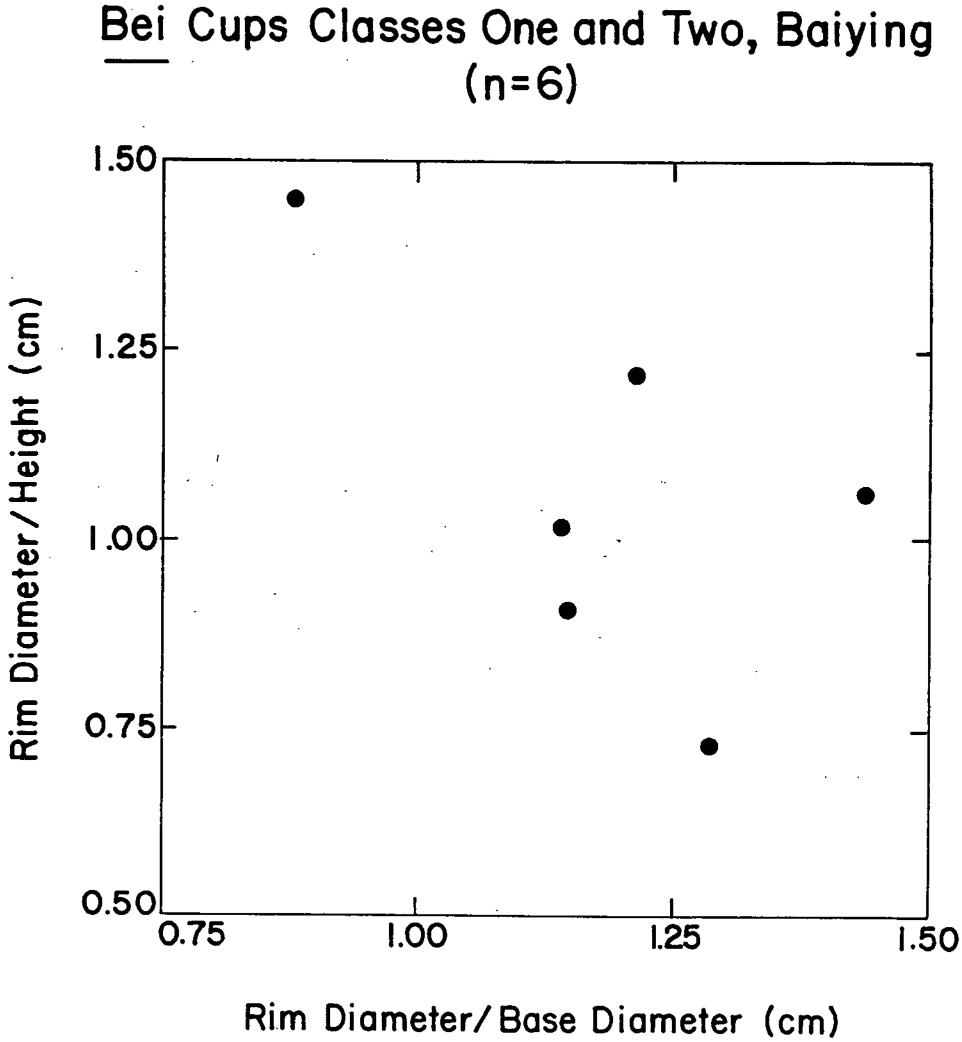

Ding Tripod Class Seven, Lujiakou
(n=7)
1.20
1.10
1.00
0.90
0.80
0.70
0.80
0.90
1.00
C
B
B
A
B
A
A
Maximum Diameter/Body Height (cm)
Orfice Diameter/Maximum Diameter (cm)

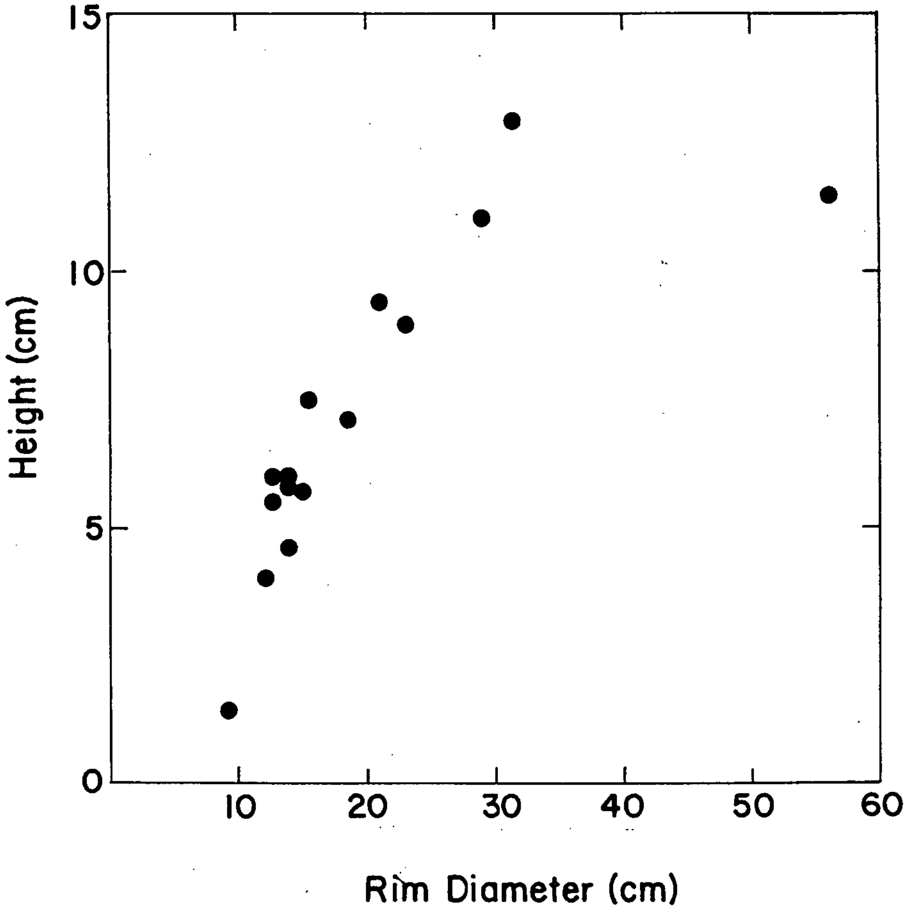
Figure 18.



Bei Cups Classes One and Two, Baiying
(n=6)
1.50
1.25
1.00
0.75
0.50
0.75
1.00
1.25
1.50
Rim Diameter/Height (cm)
Rim Diameter/Base Diameter (cm)

Figure 19.

Sizes of Gai Lids, Classes One to Eleven, Baiying (n=16)



APPENDIX B. DETAILS ON ANALYSES FOR TESTING THE MODEL OF CHANGE IN SYSTEMS OF CERAMIC PRODUCTION IN RELATION TO INCREASING CULTURAL COMPLEXITY.

site reports:

Hougang (Anyang Archaeological Team, IA, CASS 1985)

Baiying (CPAM of Anyang District, Henan Province 1983)

Meishan (Second Henan Archaeological Team, IA, CASS 1982)

Lujiakou (Shandong Archaeological Team, IA, CASS and the Art Museum of Weifang County, Shandong Province 1985)

Table 49. Distribution of Vessels in Shape Classes Per Phase at Hougang.

*** note: For each phase, the first figures refer to quantities of vessels in each shape class available for analysis; the figures in parentheses refer to my estimates of the total number of vessels excavated. The total number of vessels in each original shape class, given in the last column, is clearly stated in the report. In some cases when new classes have been established, the total number of vessels excavated per class is not clear.
("sh"= sherds)

shape class	Early	Middle	Late	total
guan jar, large	2 (8)	8 (26)	5 (19)	(53)
guan jar, medium	3 (17)	7 (22)	8 (14)	(53)
guan jar, small	2 (5)	1 (8)	2 (3)	(16)
shenfupen jar	0 (1)	1 (1)	3 (4)	(6)
pen jar, one	2 (2)	0 (1?)	0 (0)	(12 total)
two	1 (1)	1 (6)	2 (2)	
gang jar, one	0 (?)	2 (5?)	0 (0?)	(11 total)
gang jar, two	0 (?)	1 (2?)	3 (4?)	
weng necked jar	1 (5)	2 (12)	2 (7)	(24)
ping necked jar	1 (4)	1 (1)	1 (1)	(6)
hu necked jar	0 (0)	1 (1)	1 (4)	(5)
pingdipen basin,				(25 total)
medium-sized	5 (6?)	5 (5?)	13 (13?)	
large size	0 (0)	1 (1)	0 (0)	
sizumin basin	1 (2)	2 (2)	0 (1)	(5)

wan bowl, one	10 (?)	15 (?)	19 (?)	(82 total)
wan bowl, two	0 (?)	0 (?)	2 (?)	
wan bowl, three	1 (?)	0 (?)	1 (?)	
wan bowl, four	0 (?)	0 (?)	1 (?)	
wan bowl, five	1 (?)	0 (?)	0 (?)	
bo bowl	1 (1)	0 (0)	1 (1)	(2)
xian/yan tripod	4 (5)	5 (11)	3 (5)	(21)
li tripod	1 (1)	2 (4)	2 (3)	(8)
jia tripod, one	1 (1)	2 (5)	2 (3)	(9)
jia tripod, two	1 (2)	1 (3)	1 (1)	(6)
ding tripod	1 (?)	2 (?)	5 (?)	(8? 14 legs)
gui tripod	1 (?)	0 (?)	3 (?)	(7 sh)
zeng perforated jar	1 (?)	1 (?)	0 (?)	(7)
bi grate, one	0 (0)	1 (1)	0 (0)	(2 to-) tal)
bi grate, two	1 (1)	0 (0)	0 (0)	
quanzupan, one	2 (4)	0 (0)	0 (0)	(16 total)
quanzupan, two	1 (2)	2 (4)	2 (6)	
dou dish, one	1(2)	1 (3)	1 (5)	(10)
dou dish, two	1 (1)	1 (3)	1 (2)	(6)
zhefupen basin	1 (2)	1 (5)	1 (2)	(9)
bu container	0 (0)	1 (1)	0 (0)	(1)
zuo stand	1 (2)	0 (0)	0 (0)	(1)
bei cup, one	0 (0)	0 (0)	2 (5?)	(8 total)
bei cup, two	0 (0)	0 (0)	1 (2?)	
bei cup, three	0 (0)	1 (1)	0 (0)	

gai lid, one	1 (1)	3 (7)	2 (3)	(11)
gai lid, two	2 (2)	1 (2)	4 (14)	(18)
gai lid, three	0 (?)	1 (?)	0 (?)	(2)
gai lid, four	0 (0)	1 (1)	0 (0)	(1)
gai lid, five	1 (?)	0 (?)	0 (?)	(4)

Table 50. Distribution of Vessels in Shape Classes Per Phase at Baiying.

*** note: For each phase, the first figures refer to quantities of vessels in each shape class available for analysis. The figures in parentheses are the total number of vessels excavated as stated in the report. In some cases for new classes defined in Chapter 4, the total number of vessels excavated per class is not clear.

shape class	Early	Middle	Late	Total
guan jar, one	1 (1)	0 (0)	0 (0)	(1)
guan jar, two	0 (0)	0 (0)	2 (2)	(2)
guan jar, three	0 (0)	1 (2)	0 (0)	(2)
guan jar, four	0 (0)	0 (0)	2 (3)	(3)
guan jar, five	0 (0)	0 (0)	1 (1)	(1)
guan jar, six	0 (0)	1 (2)	1 (1)	(3)
guan jar, seven	0 (0)	1 (1)	0 (0)	(1)
guan jar, eight, medium	0 (0)	3 (4)	7 (15)	(19)
guan jar, eight, large	0 (0)	0 (0)	1 (1)	(1)
guan jar, nine	0 (0)	1 (1)	0 (0)	(1)
weng necked jar	0 (0)	0 (0)	2 (2)	(2)
pingdipen basin, one				
medium-sized	1 (2)	4 (4)	1 (16)	(22)
one, large	1 (1)	0 (0)	0 (0).	(1)
pingdipen basin, two	0 (0)	0 (0)	1 (2)	(2)
pingdipen basin, three	0 (0)	0 (0)	1 (1)	(1)
wan bowl, one	0 (0)	1 (1)	0 (0)	(1)
wan bowl, two	0 (0)	1 (1)	0 (0)	(1)
wan bowl, three	0 (0)	0 (0)	1 (2)	(2)
wan bowl, four	0 (0)	0 (0)	1 (3)	(3)
bo bowl	1 (1)	0 (0)	0 (0)	(1)
xian (yan) tripod	0 (0)	0 (0)	5 (5)	(5)
li tripod	1 (1)	0 (0)	1 (1)	(2)

jia tripod, one	0 (0)	0 (0)	3 (7?)	(7?)
jia tripod, two	1 (1)	2 (2)	0 (0)	(3)
jia tripod, three	2 (2)	0 (0)	0 (0)	(2)
ding tripod, one	1 (1)	2 (2)	6 (7)	(10)
ding tripod, two	0 (0)	0 (0)	1 (1)	(1)
gui tripod	0 (0)	1 (1)	3 (7)	(8)
zeng perforated jar	0 (0)	0 (0)	2 (7)	(7)
bi grate	0 (0)	0 (0)	1 (1)	(1)
quanzupan dish	0 (0)	0 (0)	1 (6)	(6)
dou stemmed dish	0 (0)	0 (0)	3 (3)	(3)
shuangfupen basin	1 (1)	1 (1)	0 (0)	(2)
qufupen basin, one	1 (1)	0 (0)	0 (0)	(1)
qufupen basin, two	0 (0)	0 (0)	1 (1)	(1)
qufupen basin, three	0 (0)	0 (0)	1 (1)	(1)
panxingqi dish	0 (0)	0 (0)	1 (1)	(1)
pan plate	0 (0)	1 (1)	0 (0)	(1)
zuo stand	1 (1)	0 (0)	0 (0)	(1)
lei-bo engraved bowl	0 (0)	0 (0)	1 (1)	(1)
zun container	0 (0)	0 (0)	1 (1)	(1)
bei cup, one	0 (0)	1 (1)	0 (0)	(1)
bei cup, two	1 (1)	1 (1)	5 (5)	(7)
bei cup, three	0 (0)	0 (0)	1 (1)	(1)
bei cup, four	0 (0)	0 (0)	4 (4)	(4)
bei cup, five	0 (0)	0 (0)	1 (1)	(1)
pitcher, one	1 (1)	0 (0)	0 (0)	(1)
pitcher, two	0 (0)	0 (0)	1 (1)	(1)
pitcher, three	0 (0)	2 (2)	0 (0)	(2)
pitcher, four	0 (0)	1 (1)	0 (0)	(1)

gai lid, one	1 (1)	3 (7?)	1 (7)	(17?)
gai lid, two	1 (1)	2 (2)	0 (0)	(3)
gai lid, three	1 (1)	0 (0)	0 (0)	(1)
gai lid, four	0 (0)	1 (3?)	0 (0)	(4?)
gai lid, five	0 (0)	1 (2)	0 (0)	(2)
gai lid, six	0 (0)	0 (0)	2 (2)	(2)
gai lid, seven	0 (0)	0 (0)	1 (1)	(1)
gai lid, eight	0 (0)	0 (0)	1 (1)	(1)
gai lid, nine	0 (0)	0 (0)	1 (1)	(1)
gai lid, ten	0 (0)	0 (0)	1 (1)	(1)
gai lid, eleven	0 (0)	0 (0)	1 (1)	(1)

Table 51. Distribution of Vessels in Shape Classes Per Phase at Meishan.

*** note: Only quantities of vessels available for analysis are given here; the report does not provide figures for the total number of excavated vessels from each shape class.

shape class	Early	Late
guan jar	3	5
dakouguan, large-mouthed jar	1	1
round necked jar	2	0
xiaoguan, small guan	0	1
necked small jar	0	2
weng necked jar	2	3
large necked jar	0	1
wide rimmed bowl	1	1
wan bowl, one	8	4
wan bowl, two	1	1
wan bowl, three	1	1
wan bowl, four	1	0
wan bowl, five	0	1
lei-bo engraved bowl, one	3	2
lei-bo, two	1	0
xian/yan tripod	0	1
jia tripod	1	0
ding tripod	9	7

gui tripod	1	2
zeng perforated jar	2	1
bi grate	1	1
quanzupan pedestalled dish, one	2	0
quanzupan, two	2	1
dou stemmed dish	4	3
qufupen carinated basin	1	0
he container	1	0
danerbei cup with handle, one	1	0
danerbei, two	0	2
gu beaker	2	2
zhefubei, carinated cup	1	0
chuxingbei, pestle-shaped cup	1	2
yuanfubei, round cup	0	2
zunxingbei, zun-shaped cup	0	1
gai lid, one	1	2
gai lid, two	2	1

Table 52. Distribution of Vessels in Shape Classes Per Phase at Lujiakou.

*** note: The first figures refer to quantities of vessels in each shape class available for analysis. The figures in parentheses refer to the number of vessels excavated. In some cases, particularly when new shape classes have been established, there is only information on the total number of vessels excavated. There is no information for each phase.

shape class	Early	Late	Total
guan jar, one	2 (2?)	1 (1?)	(6 for
guan jar, two	1 (1)	0 (0)	classes
guan jar, three	0 (0?)	2 (2?)	one-three)
guan jar, four	0 (0)	1 (1)	(1)
guan jar, five	1 (2?)	0 (0?)	(2)
guan jar, six	0 (0)	1 (1)	(1)
guan jar, seven	1 (?)	1 (?)	(10)
guan jar, eight	1 (?)	1 (?)	(3)
guan jar, nine	0 (0)	2 (0)	(2)
hu necked jar	2 (2)	1 (1)	(3)
lei necked jar	0 (0)	1 (1)	(1)
pen basin, one	0 (?)	3 (?)	(19 for
pen basin, two	2 (?)	1 (?)	classes
pen basin, three	1 (?)	1 (?)	one-three)
pen basin, four	0 (0)	2 (2)	(2)
pen basin, five	0 (0)	3 (3)	(3)
pen basin, six	0 (?)	1 (?)	(8 for
pen basin, seven	0 (?)	2 (?)	classes
			six, seven)
pen basin, eight	0 (0)	1 (1)	(1)
pen basin, nine	0 (0)	1 (1)	(1)
pen basin, ten	0 (0)	1 (1)	(1)
wan bowl, one	3 (?)	14 (?)	(26 for
wan bowl, two	0 (?)	1 (?)	classes
			one-two)

dailiubo, _bo_ bowl with spout	0 (0)	2 (2)	(2)
xian/yan tripod	0 (0)	1 (1)	(1)
gui tripod	3 (3)	1 (1)	(4)
ding tripod, one	1 (?)	2 (?)	(12 for
ding tripod, two	0 (?)	1 (?)	classes
ding tripod, three	0 (?)	1 (?)	one-six)
ding tripod, four	0 (?)	1 (?)	
ding tripod, five	0 (?)	1 (?)	
ding tripod, six	0 (?)	1 (?)	
ding tripod, seven	3 (?)	4 (?)	(12)
_bi_ grate	0 (0)	1 (1)	(1)
sanzupan, 3 footed _pan_, one	1 (1)	1 (1)	(2)
sanzupan, two	1 (1)	1 (1)	(2)
sanzupan, three	1 (1)	1 (1)	(2)
sanzupan, four	0 (0)	1 (1)	(1)
dou stemmed dish	1 (1)	3 (3)	(4)
_yu_ container, one	1 (0)	0 (0)	(1)
_yu_ container, two	1 (0)	0 (0)	(1)
bei cup, one	0 (0)	2 (2)	(2)
bei cup, two	0 (0)	2 (2)	(2)
bei cup, three	0 (0)	1 (1)	(1)
bei cup, four	1 (1)	0 (0)	(1)
gai lid, one	0 (0)	1 (1)	(1)
gai lid, two	0 (0)	1 (1)	(1)
gai lid, three	1 (1)	1 (1)	(2)
gai lid, four	0 (0)	1 (1)	(1)

Table 53. Diversity of Shape Classes and Hypothesized Functional Types Per Period at Hougang.

functional type	Early	Middle	Late
cooking tripods (xian/yan, li, jia one and two, ding, gui)	6 forms	5	6
other cooking pots (medium and large guan jar, zeng jar, bi grate one and two)	4	4	2
other jars with wide orifice (small guan, shenfupen, pen one and two, gang one, two) storage function	4	6	4
jars, narrow orifice (weng, ping, hu) for liquid storage	2	3	3
bowls (wan one, two, three, four, five, bo) for eating, serving, drinking	4	1	5
other open forms, no pedestal or stem (pingdipen basin, medium and large size; zhefupen basin) preparing, serving food	2	3	2

open forms with pedestal or stem (dou dish one, two; quanzupan dish one, two; bu container sizumin footed pot) serving, eating food)	5	5	4
cups (bei one-three) for drinking	0	1	2
lids for covering other vessels (gai class four)	0	1	0
lids for serving food (gai one, two, three, five)	3	3	2
other (zuo stand)	1	0	0
TOTAL NUMBER FORMS (46 at whole site)	31	32	30

Table 54. Diversity of Shape Classes and Hypothesized Functional Types Per Period at Baiying.

functional type	Early	Middle	Late
cooking tripods (xian/yan, li, jia one, two, three; ding one, two; gui)	4 forms	3	6
other cooking pots (guan jar eight, medium; zeng jar, bi grate)	0	1	3
other jars with wide orifice (guan jar five, six, seven, eight medium (fine paste), large; nine for storage	0	4	4
jars with narrow orifice (guan jars with necks - one, two, three, four; weng jar); liquid storage	1	1	3
bowls (wan one, two, three, four; bo) for eating, drinking, serving	1	2	2
other open forms with no pedestal or stem (pingdipen basin one, medium and large size; two, three; shuangfupen basin, qufupen basin one, two, three; pan plate, panxingqi dish, lei-bo bowl) for preparing, serving food	3	3	6
open forms with pedestal or stem (dou dish, quanzupan dish); serving, eating food	0	0	2

pitchers (one, two, three, four)	1	2	1
cups (bei one, two, three, four, five; zun container) for drinking	1	2	5
lids (gai one) for covering other vessels	1	1	1
lids (gai classes two - eleven) for serving food	2	3	6
other (zuo stand)	1	0	0
TOTAL NUMBER OF FORMS (62 at whole site)	15	22	40

Table 55. Diversity of Shape Classes and Hypothesized Functional Types Per Period at Meishan.

functional type	Early	Late
cooking tripods (xian/yan, ding, jia, gui)	3 forms	3
other cooking pots (guan jar, zeng jar, bi grate)	3	3
other jars with wide orifice, for storage (dakouguan, xiaoguan)	2	1
jars with narrow orifice, for liquid storage (weng, round necked jar, large necked jar, small jar with neck)	2	3
bowls for eating, serving, drinking (wan one, two, three, four, five; wide-rimmed bowl)	5	5
other open forms, no pedestal or stem, for preparing or serving food (qufupen, he, lei-bo one and two)	4	1
open forms with pedestal or stem for serving, eating food (dou, quanzupan one, two)	3	2
cups for drinking (gu, danerbei one, two; zhefubei, chuxingbei, yuanfubei, zunxingbei)	4	5

lids for serving food (_gai_ one, two)	2	2
TOTAL NUMBER OF FORMS (35 at whole site)	27	26

Table 56. Diversity of Shape Classes and Hypothesized Functional Types Per Period at Lujiakou.

functional type	Early	Late
cooking tripods (xian/yan, gui, ding seven)	2 forms	3
other cooking pots (bi grate, guan jar seven)	1	2
other jars with wide orifice, for storage (guan jar three, five, six)	1	2
jars with narrow orifice, for liquid storage (guan jar one, two, four, eight, nine; hu, lei)	4	6
bowls for eating, serving, drinking (wan one, two, three; dailiubo)	1	4
other open forms, no stem or pedestal, for preparing or serving food (pen basin one-ten; yu container, one, two)	4	12
open forms with pedestal, stem, or legs for serving, eating food (dou dish, sanzupan dish one-four, ding tripod one-six)	5	11
cups for drinking (bei one-four)	1	3

lids for covering other vessels (gai one - three)	1	2
lids for serving food (gai two)	0	2
TOTAL NUMBER OF FORMS (50 at whole site)	20	47

Table 57. Variation in Shape of Leg for _Xian/Yan_ Tripods, Hougang.

shape of legs	Early	Middle	Late
awl shaped	2	2	1
pouch shaped	0	1	2
no data- legs broken	2	2	0
total number of vessels	4	5	3
total number of shapes	2	3	2
total number of excavated houses	2	14	23

Table 58. Variation in Handles for _Xian/Yan_ Tripods, Hougang.

feature	Early	Middle	Late
none	4	3	3
2 small handles with loop	0	1	0
2 solid lugs	0	1	0
total number of vessels	4	5	3
total number of handle types	1	3	1
total number of excavated houses	2	14	23

Table 59. Variation in Shape of Leg for *Ding* Tripods, Hougang.

shape of legs	Early	Middle	Late
round pillar	0	0	2
long and triangular	1	0	0
short and triangular	0	0	1
sawtooth	0	1	1
guilian ("grimace", or "funny face")	0	1	1
total number of vessels	1	2	5
total number of shapes	1	2	4
total number of excavated houses	2	14	23

Table 60. Variation in Decorative Techniques for Large *Guan* Jars, Hougang.

techniques	Early	Middle	Late
basket marks (impressions), and a few incised lines	0	0	1
cordmarks (impressions)	1	1	1
cordmarks, long and thin applique, incised lines, and incision around rim	0	1	1
basketmarks	0	1	0
plain- no decoration	0	1	0
checkmarks (impressions)	0	1	1
basketmarks and cordmarks	0	1	0
cordmarks and incision around rim	1	2	0
cordmarks, circular applique, thin and long applique, polished rim	0	0	1
total number of vessels	2	8	5
total number of decorative combinations	2	7	5
total number of excavated houses per phase	2	14	23

Table 61. Variation in Decorative Techniques for Medium-Sized <u>Guan</u> Jars, Hougang.

techniques	Early	Middle	Late
cordmarks	1	4	3
cordmarks and incision around rim	1	0	0
cordmarks, long and thin applique, incised lines	1	0	0
plain- no decoration	0	2	1
basketmarks	0	1	0
checkmarks	0	0	2
checkmarks and cordmarks	0	0	1
checkmarks and incision around rim	0	0	1
total number of vessels	3	7	8
total number of decorative combinations	3	3	5
total number of excavated houses	2	14	23

Table 62. Variation in Decorative Techniques for *Xian*/*Yan* Tripods, Hougang.

techniques	Early	Middle	Late
basketmarks	1	0	0
cordmarks	3	2	1
cordmarks and incision around rim	0	1	0
cordmarks and 3 small knobs	0	0	1
cordmarks, 3 small knobs, and incision around rim	0	1	0
cordmarks, 2 incisions around rim	0	1	0
basketmarks and 3 small knobs	0	0	1
total number of vessels	4	5	3
total number of decorative combinations	2	4	3
total number of excavated houses	2	14	23

Table 63. Variation in Type of Rim for Wan Bowls, Class One, Hougang.

type of rim	Early	Middle	Late
plain	10	10	13
one incision around rim	0	3	6
two incisions around rim	0	2	0
total number of vessels	10	15	19
total number of rim types	1	3	2
total number of excavated houses	2	14	23

Table 64. Variation in Handles for *Ding* Tripods, Class One, Baiying.

feature	Early	Middle	Late
panshou loop handle	0	0	1
none	1	2	5
total number of vessels	1	2	6
total number of types	1	1	2
total number of excavated houses	9	8	46

Table 65. Variation in Decorative Techniques for *Ding* Tripods, Class One, Baiying.

techniques	Early	Middle	Late
cordmarks	0	1	5
checkmarks	1	1	0
cordmarks and checkmarks	0	0	1
total number of vessels	1	2	6
total number of decorative combinations	1	2	2
total number of excavated houses	9	8	46

Table 66. Variation in Shape of Leg for *Ding* Tripods, Meishan.

shape of leg	Early	Late
round pillar	1	1
triangular	3	2
nipple	2	1
triangular, one hole	1	0
triangular, two holes	1	0
bird beak	0	1
no data- broken legs	1	2
total number of vessels	9	7
total number of shapes	6	5
total number of excavated houses	17	16

Table 67. Variation in Decorative Techniques for *Guan* Jars, Meishan.

techniques	Early	Late
basketmarks	1	2
checkmarks	1	2
basketmarks and several incised lines	1	0
basketmarks, polished upper shoulder	0	1
total number of vessels	3	5
total number of decorative combinations	3	3
total number of excavated houses	17	16

Table 68. Variation in Decorative Techniques for *Dou* Stemmed Dishes, Meishan.

techniques on stem	Early	Late
none	3	2
2 incised lines	1	0
one ridge	0	1
total number of vessels	4	3
total number of decorative combinations	2	2
total number of excavated houses	17	16

Table 69. Variation in Decorative Techniques for *Ding* Tripods, Meishan.

techniques	Early	Late
checkmarks, and incised lines on shoulder	1	0
checkmarks	2	4
basketmarks	1	2
checkmarks and incision around rim	1	0
cordmarks	0	1
total number of vessels	5	7
total number of decorative combinations	4	3
total number of excavated houses	17	16

Table 70. Variation in Shape of Leg for *Ding* Tripods, Class Seven, Lujiakou.

shape of leg	Early	Late
round pillar	1	2
vertical strips, applique	1	1
chisel	1	0
no data- broken legs	0	1
total number of vessels	3	4
total number of shapes	3	3
total number of excavated houses	6	5

Table 71. Variation in Handles for *Ding* Tripods, Class Seven, Lujiakou.

feature	Early	Late
4 cockscomb handles	1	1
3 cockscomb handles	0	1
2 cockscomb handles	0	1
2 *bi* lugs	0	1
none	2	0
total number of vessels	3	4
total number of handle types	2	4
total number of excavated houses	6	5

Table 72. Variation in Decorative Techniques for *Ding* Tripods, Class Seven, Lujiakou.

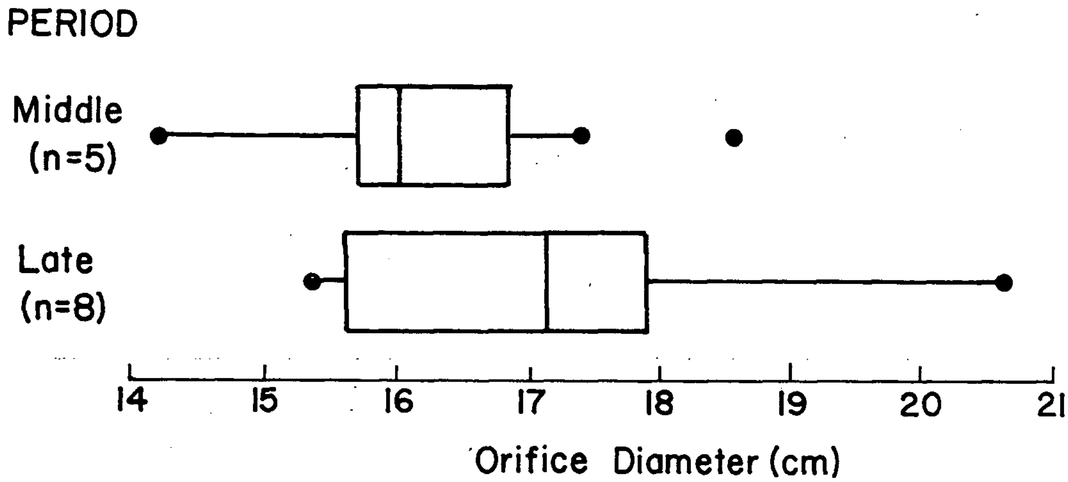
techniques	Early	Late
polishing	1	0
plain- no decoration	0	1
incised line on body and incision around rim	1	0
basketmarks	1	0
incision around rim	0	1
2 incised lines on body	0	1
3 incised lines on shoulder, incision around rim	0	1
total number of vessels	3	4
total number of decorative combinations	3	4
total number of excavated houses	6	5

Table 73. Variation in Decorative Techniques for *Wan* Bowls, Class One, Lujiakou.

techniques	Early	Late
plain- no decoration	3	4
two incised lines	0	3
total number of vessels	3	7
total number of decorative combinations	1	2
total number of excavated houses	6	5

Figure 20. (Page I)

Variation in Dimensions by Period, Large _Guan_ Jars, Hougang



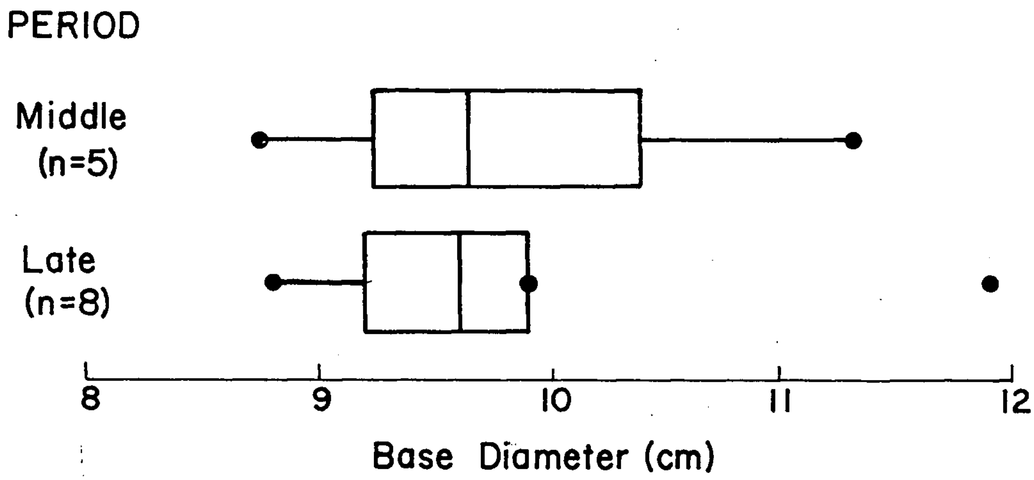
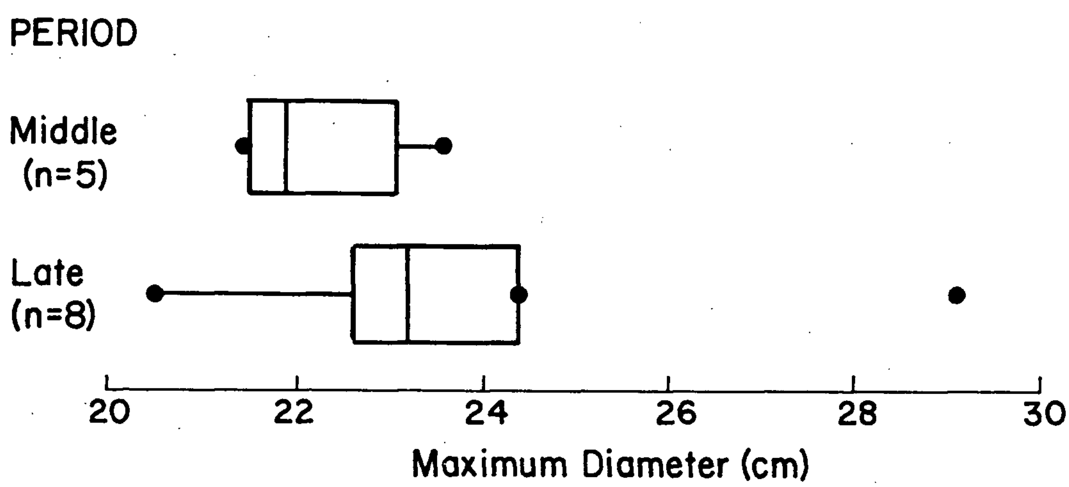


Figure 20. (Page 2)

Variation in Dimensions by Period, Large *Guan* Jars, Hougang



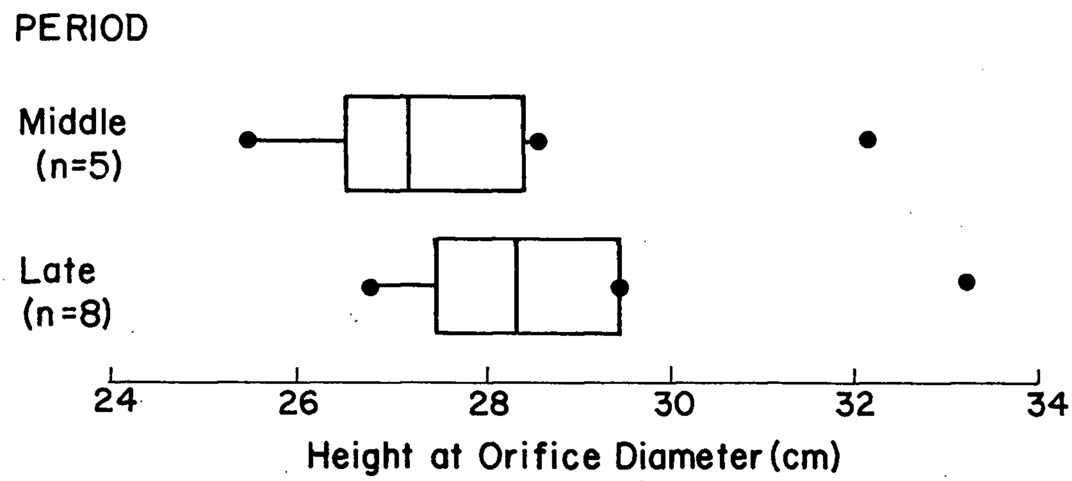
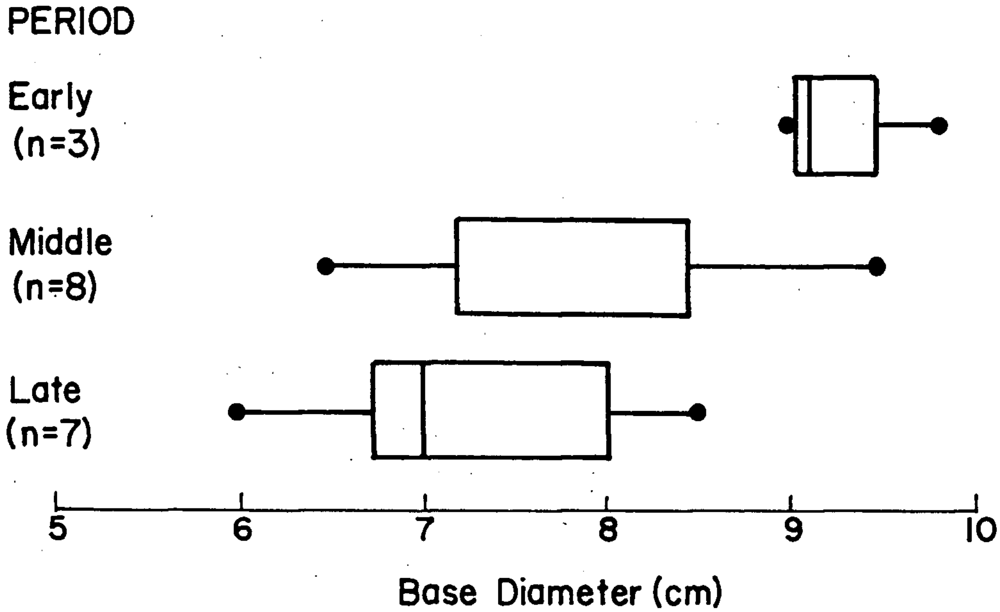


Figure 21.(Page 1)

Variation in Dimensions by Period, Medium Size *Guan* Jars, Hougang



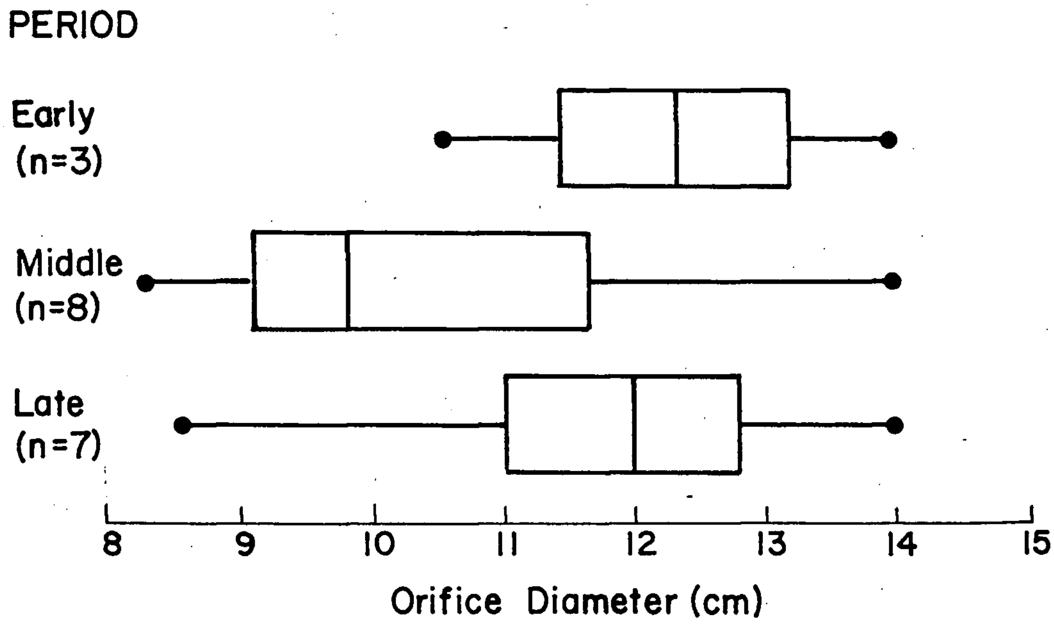
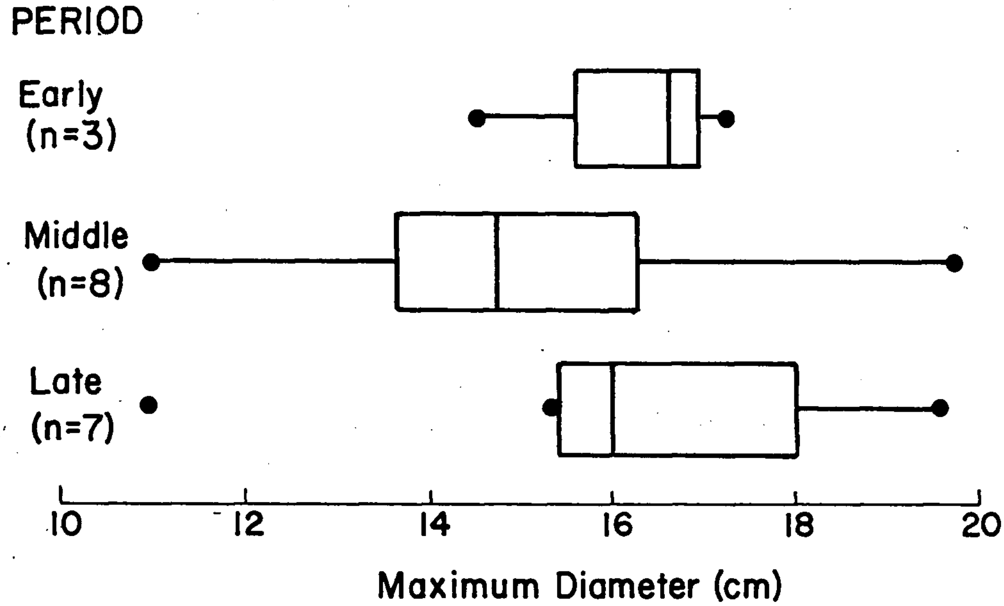


Figure 21. (Page 2)

Variation in Dimensions by Period, Medium Size *Guan* Jars, Hougang



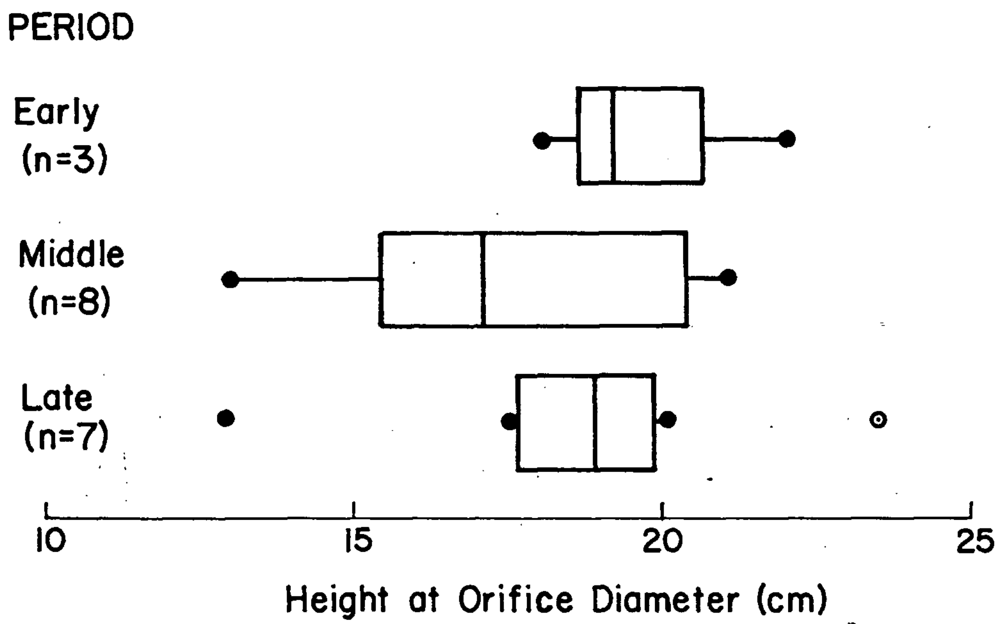


Figure 22.

Variation in Dimension by Period, Medium Size Pingdipen Basins, Hougang

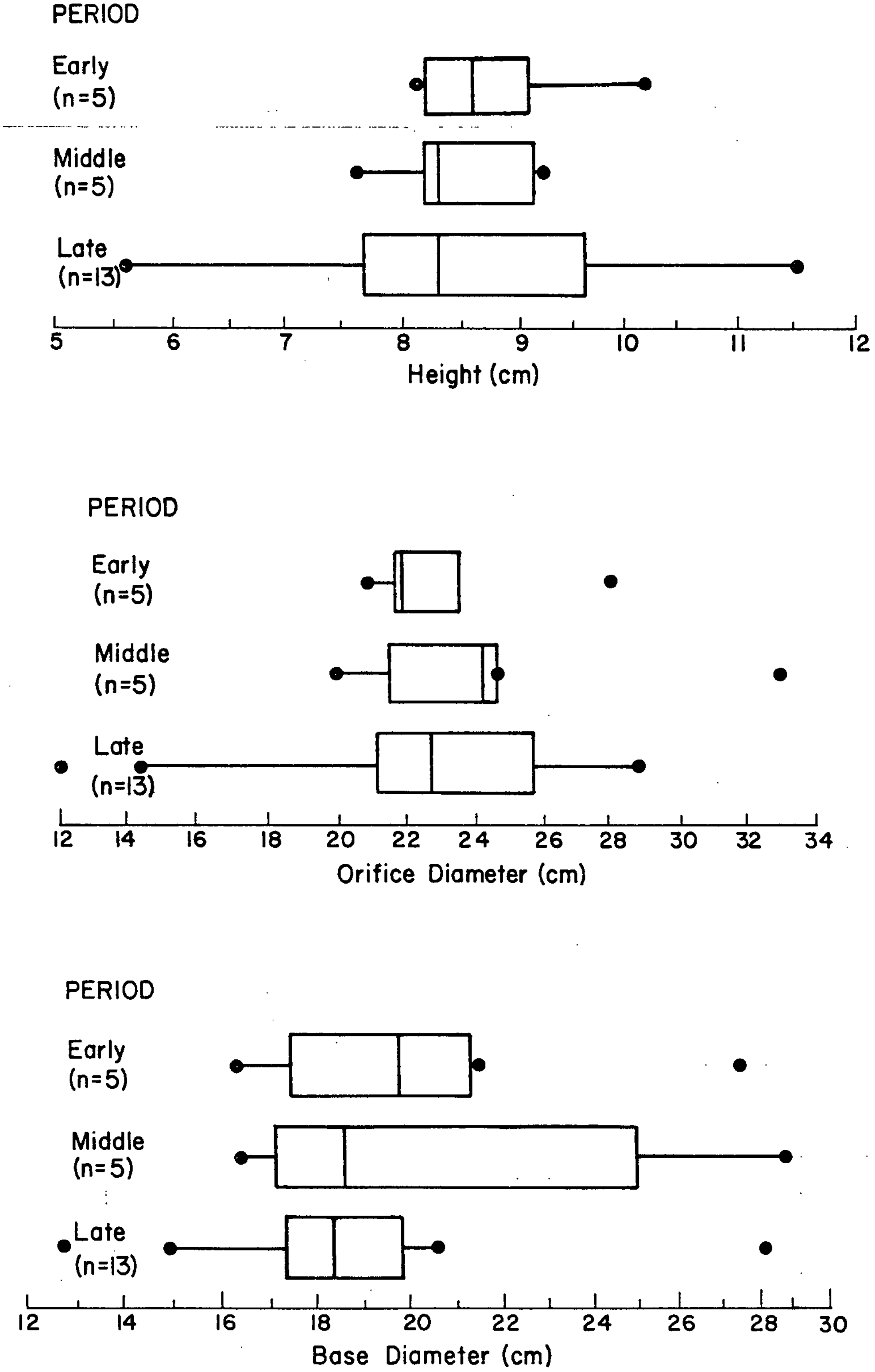


Figure 23.

Variation in Dimension by Period, Medium Size Wan Bowls, Class One, Hougang

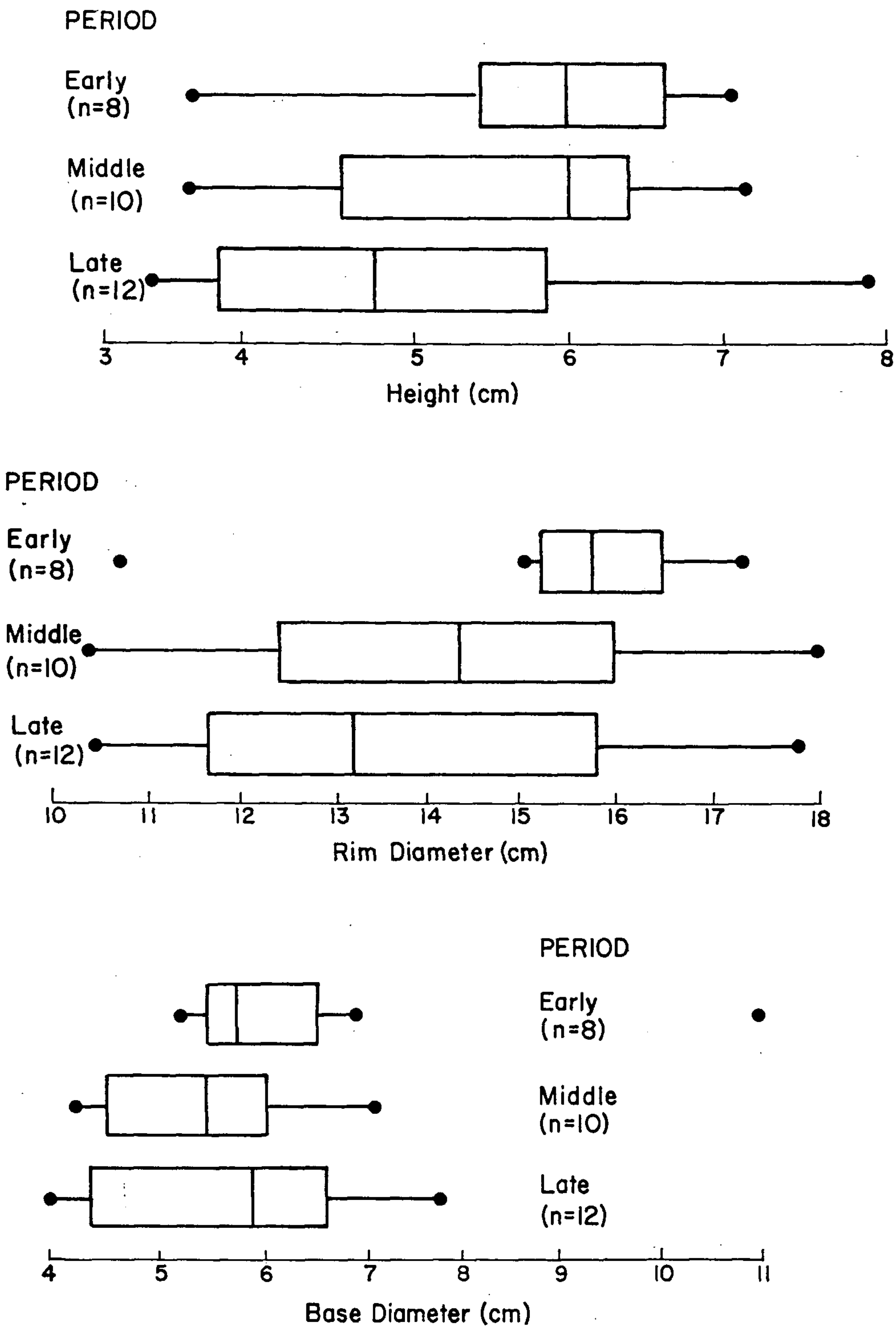


Figure 24.

Variation in Dimensions by Period, Guan Jars, Meishan

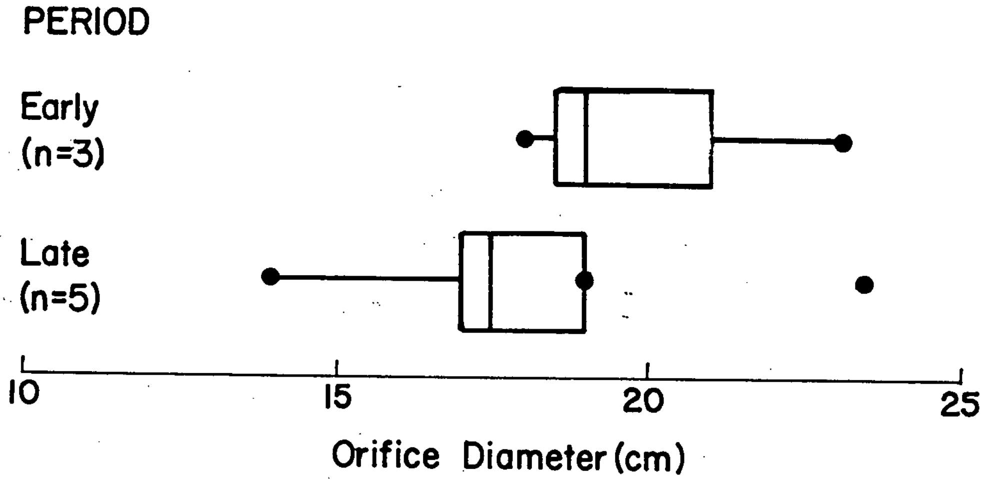
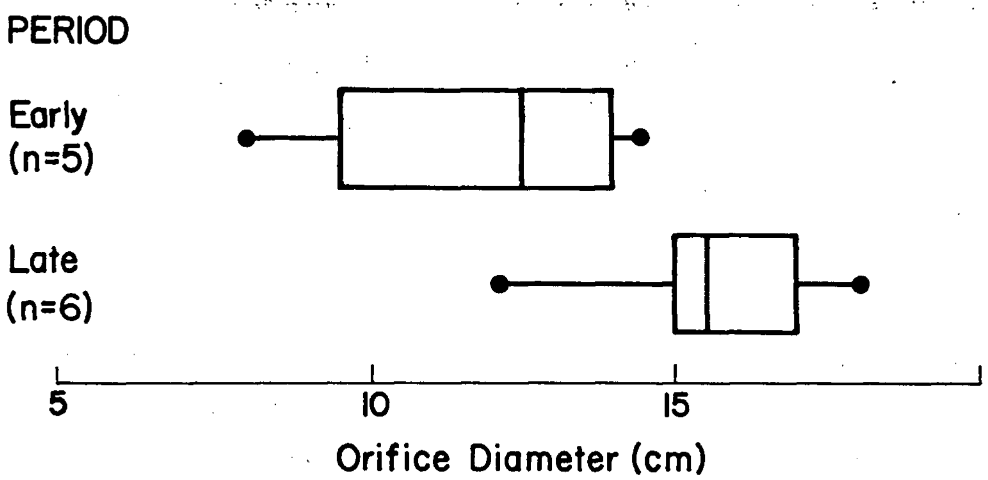


Figure 25.

Variation in Dimensions by Period, Ding Tripods, Meishan



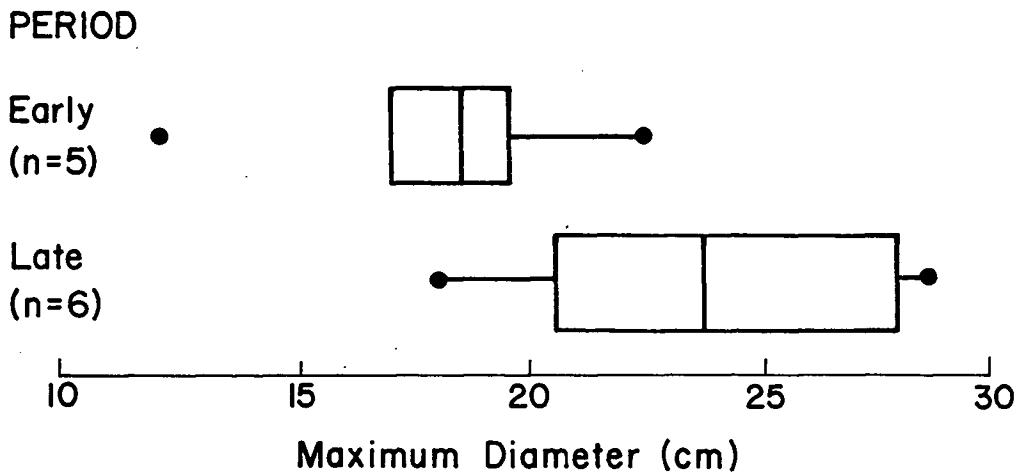
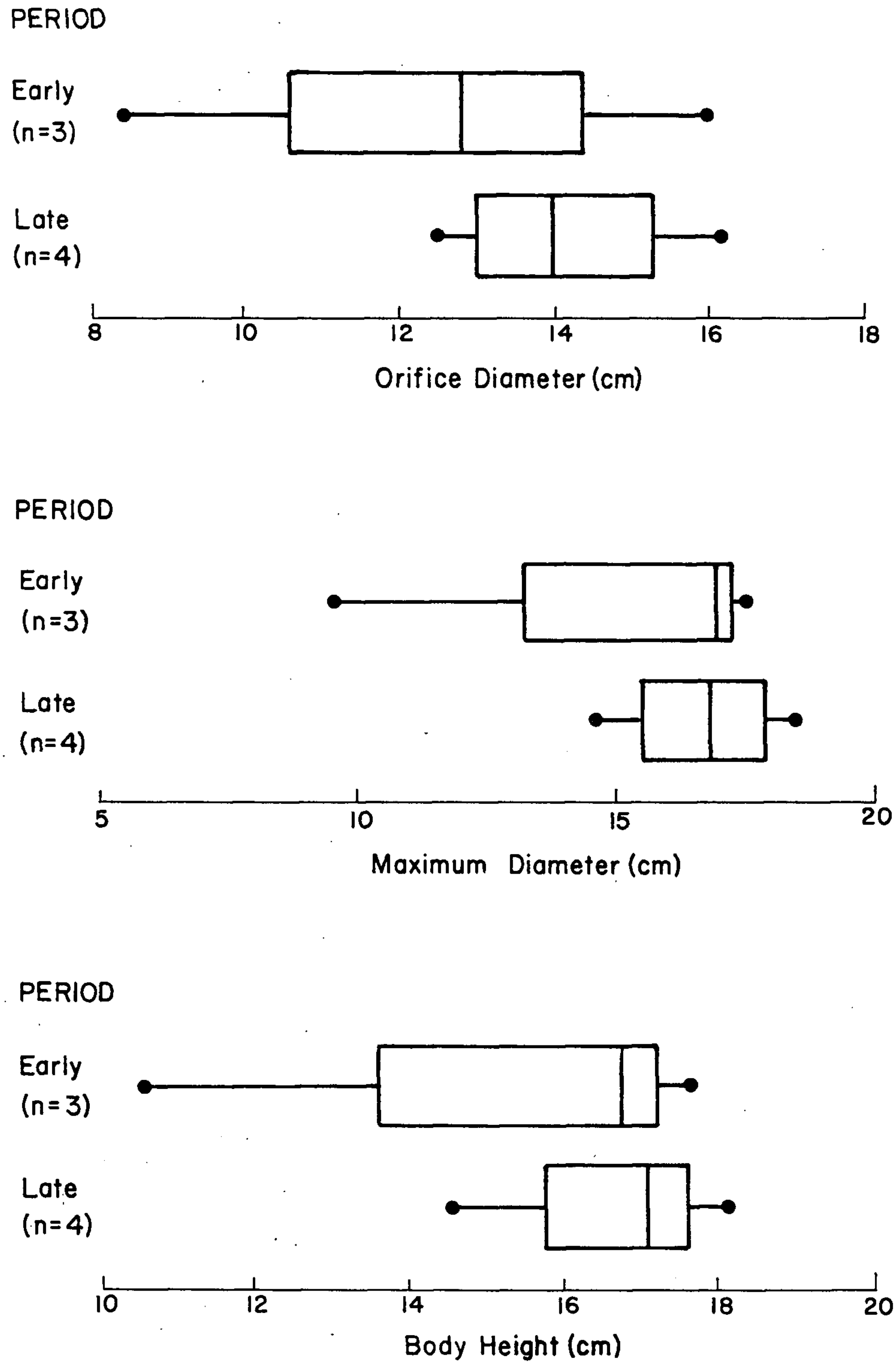


Figure 26.

Variation in Dimensions by Period, Ding Tripods, Lujiakou



APPENDIX C. DATA ON NONCERAMIC POTENTIAL PRESTIGE GOODS, UTILITARIAN ARTIFACTS, AND HOUSING AT HOUGANG AND BAIYING.

site reports:

Hougang (Anyang Archaeological Team, IA, CASS 1985)

Baiying (CPAM of Anyang District, Henan Province)

Table 74. Distribution of Potential High Status Artifacts Among Different Types of Sites, with Location of Deposition by Excavation (T) Area.
(note: for Hougang, E= Early, M= Middle, L= Late; numbers indicate layers)

	jade	bronze	oracle bones	ornaments
<u>walled sites</u>				
<u>Hougang</u> (period not stated for most artifacts)	1 <u>huan</u> ring, E6, in T2; 3 <u>bi</u> disks, 1 in M5 pit T15-16	--	1 E6, T9	stone: 2 <u>huan</u> rings; bone: 6 <u>ji</u> hairpins; 3 <u>guan</u> tubes; ceramic: 41 <u>huan</u>; 1 small molded human or animal head, E7; shell: 1 piece, M5; 2 pierced pieces
<u>smaller sites without walls</u>				
<u>Baiying</u>				
Early	--	--	2, areas unclear	bone: 1 <u>ji</u> pin, 1 piece; ceramic: 12 <u>huan</u>;

				shell: 1 huan
Middle	--	--	--	stone: 1 huan; bone: 5 ji; ceramic: 24 huan
Late	3 strings of beads T25, T16, T49; 3 flat pieces T44, T21, T4	--	8, 1 in T28	stone: 3 huan; bone: 1 piece, 4 ji, 1 guan, 2 pierced pieces, 2 horn pieces, 2 tooth items; ceramic: 1 small bird, 8 huan; shell: 1 huan, 1 round item
Meishan				
Early	--	--	--	bone: 2 ji; ceramic: 2 huan, 1 ball, 1 human figure, 2 birds
Late	--	traces on 2 crucibles areas unclear	2, areas unclear	bone: 2 ji; ceramic: 1 ball, 3 huan, 2 birds

Lujiakou

(period not stated for most artifacts)	--	--	--	stone: 1 huan, Late; bone: 11 ji; ceramic: 12 huan, 1 animal

Table 75. Diversity of Utilitarian Tools for Different Types of Sites.
(note: the first figure is the number of forms, the second figure in parentheses is the quantity of items)

	stone	bone/ horn	shell	wood	pottery
<u>walled sites</u>:					
<u>Hougang</u>					
(period not stated for most items)	19 (119)	8 (107)	4 (31)	1 (1)	1 (1)
<u>sites without walls</u>:					
<u>Baiying</u>					
Early	9 (23)	5 (26)	--	--	--
Middle	9 (41)	9 (56)	2 (14)	--	1 (1)
Late	18 (90)	11 (96)	5 (34)	--	2 (15)
<u>Meishan</u>					
Early	5 (16)	5 (9)	1 (2)	--	1 (2)
Late	7 (25)	6 (20)	5 (7)	--	3 (8)
<u>Lujiakou</u>					
(periods not stated for most items)	10 (75)	8 (37)	3 (36)	--	3 (30)

Table 76. Variation in Construction Material for Houses (_Fangzi_) at Hougang, Including Identification of Houses with Costly Materials.

type of wall material	Early layer 6	Middle layer 5	Late layer 4	Late layer 3
mud/earthen (_tu_)	2	10	5	6
wattle and daub (_mu gu duo ni_)	0	1	4	3
adobe (_tupi_)	0	2 F8, F18	1 F12	2 F12, F15
unknown	0	1	0	3
total	2	14	10	14

Table 77. Variation in Construction Material for Houses (*Fangzi*) at Baiying, Including Identification of Houses with Costly Materials.

type of wall material	Early	Middle	Late
earthen (*shengtu*)	4	1	0
mud and straw (*cao jin ni*)	1	5	34
wattle and daub (*mu gu ni*)	0	2	10
adobe (*tupi lei*)	0	0	1, F65
unknown	4	0	1
total	9	8	46