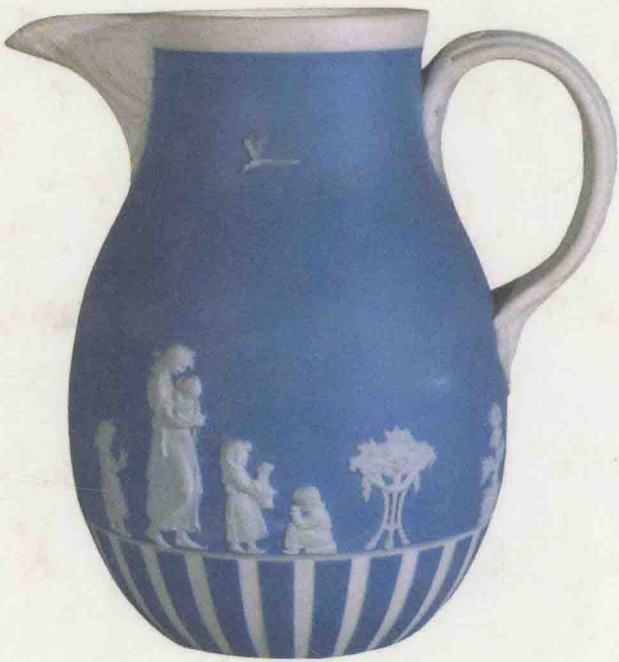
CERAMICS AND CIVILIZATION

VOLUME

V

THE CHANGING ROLES OF CERAMICS IN SOCIETY: 26,000 B.P. TO THE PRESENT

Editor: W. D. Kingery



CERAMICS AND CIVILIZATION

VOLUME

V

THE CHANGING ROLES OF CERAMICS IN SOCIETY: 26,000 B.P. TO THE PRESENT

Editor: W. D. Kingery

The American Ceramic Society, Inc.
Westerville, OH

Proceedings of a Society Symposium on History and Archaeology at the 90th Annual Meeting of the American Ceramic Society, held on May 3, 1988, in Cincinnati, Ohio.

On the cover: As discussed by Steven Reber, page 279ff, Josiah Wedgwood was one of the most remarkable ceramic innovators of the eighteenth century. Jasperware began production in 1774. This chocolate pitcher from about 1790 was made of cobalt-blue jasper dip with appliqué decoration based on a design by Lady Elizabeth Templeton and modeled by William Hackwood. The tip of the spout has been repaired (Collection of the Metropolitan Museum of Art, New York. Gift of Ferdinand Herman, 1912).

Library of Congress Cataloging-in-Publication Data

The Changing roles of ceramics in society : 26,000 B.P. to the present / editor, W. D. Kingery.
High technology ceramics.
p. cm. — (Ceramics and civilization ; v. 5)
ISBN 0-944904-11-4
1. Ceramics—History. I. Kingery, W. D. II. Series.
TP791.C48 1990 90-183
666'.09—dc 20 CIP

ISBN 0-944904-11-4

Coden: ADCEDE

Printed in the United States of America.

1 2 3 4 5—93 92 91 90

CERAMICS AND CIVILIZATION

VOLUME

V

The Changing Roles of Ceramics in Society: 26,000 B.P. to the Present

Volume I. Ancient Technology to Modern Science
Volume II. Technology and Style
Volume III. High-Technology Ceramics
Volume IV. Cross-craft and Cross-cultural Interactions in Ceramics

Preface

Several of the essays included here were presented at a 1988 American Ceramic Society symposium on the changing roles and functions of ceramics in society. Others were presented at a 1989 symposium that focused on cultures in contact as a source of ceramic change. These topics have proved sufficiently stimulating to constitute a truly exciting collection of studies that range in subject matter from the origins of ceramics, ca. 26,000 B.P., to modern lightpipes, optical devices, and the response of ceramic education to the substantial changes that have occurred during the last century.

In an introductory essay, Prudence Rice sets the stage by differentiating between function and use of pottery vessels. She concludes that although ceramic use studies are "an important new direction in archaeological research," there are some important cautions to be sounded.

Next are eight essays on specific archaeological studies in which ceramic functions, roles, uses, and changes are considered in various cultural contexts. The earliest known fired ceramic objects are the Dolne Vestonice, figurines whose processing, firing, and use are discussed by P. B. Vandiver, O. Soffer, and B. Klima. The authors conclude that the cultural role of these figurines was integral with making and firing them—that the process, not the product, was the essence of their function. Elizabeth Henrickson discusses the ways in which morphology, physical and technical attributes, and direct use modifications can serve as powerful data for archaeological studies. Applying this knowledge to utilitarian perforated pots from Chalcolithic Seh Gabi brings us much closer to understanding the function of these objects as heating and drying vessels, but leaves the specific use still to be determined. Focusing his attention on cooking pots, Michael Schiffer takes a different approach with experimental measurements of the ways in which ceramic formulations and surface treatments affect heating effectiveness and evaporative cooling. These measurements place physical limitations on optimization of use properties. These limitations, and opportunities, for workable technical solutions affect one's expectations with regard to temporal and spatial variability in cooking pots. William Barnett has studied the production and distribution of Early Neolithic pottery in the Aude Valley of Langnedoc-Roussillon, France. Models of technical diffusion or prestige exchange based on attempts to explain stylistic variations do not seem to fit the data very well. He suggests that rare and decorated Early Neolithic pottery uses an innovative technology that served a symbolic social function and should be considered in that light.

In a discussion of culture contact and ceramic evolution in Mesoamerica, Hector Neff argues that there is a continuity in the principles that apply to the evolutionary process. These common principles extend from prehistoric times into the twentieth century. In Greek pithoi, coarse undecorated containers that sometimes are several feet in diameter, Tracey Cullen and Donald Keller have described a ceramic of little intrinsic interest to most archaeologists. These vessels, however, have a long history of being used as storage vessels, water cisterns, burial containers, and twentieth-century garden decorations. Throughout their history, they are represented in story and art with a diverse imagery illustrating both their symbolic and utilitarian roles. A report on different cultures in contact, illustrating both continuity and change, is nicely shown in Flora Kaplan's discussion of the role and function of Mexican pottery for the dead, a black-

ware specially made for use on All Saint's Day. It combines pre-Columbian and Spanish Catholic components in the material itself, associated materials, and the imagery it evokes. However, as shown by Massimo Vidale in his study of stoneware of the Indus Valley, not all technological developments show continuity. With the abandonment of the large cities and state support in the Indus Valley, manufacture of stoneware was halted. No similar quality of stoneware appears again until the Chinese development almost a millennia later.

To open the section on historical studies, an essay on glass and technology by N. J. Kreidl, D. R. Uhlmann, and P. B. Vandiver provides a transition from the archaeological—glassmaking in the ancient Near East—through an historical discussion of lenses and windows of Roman times on to contemporary products. Although a Roman glass worker would be familiar with what goes on in a modern glassblower's shop, neither would be comfortable with metal glasses, sol-gel glasses, gradient index optics, optic sensors, and active optical devises. The essay illustrates how glass, a paradigm for other ancient materials technologies, continues to play a key role in modern technology.

The development of modern industrial technology began with the application of science to support industry in the eighteenth century. The different, but closely related, ways in which this occurred for ceramics—the entreprenuerial climate of England contrasted with the royal manufactory at Sèvres in France—are discussed by Steven Reber. He shows how the techniques of innovation had already become quite specialized by the end of the eighteenth century. Toward the end of the nineteenth century, the Age of Electricity began to mature. David Kingery shows how this led to the development of high technology ceramics and materials science as a recognizable field of modern research and manufacture. As described by O. J. Whittemore and L. R. McCreight, much of the work related to the 1901 zirconia Nernst filament was repeated to form high purity oxide crucibles for the Manhattan project during World War II. Indeed, this familiarity with oxide ceramics was one factor leading to MIT's leading role in the development of post-war high technology ceramics. (The other factor was the work of Arthur von Hippel's laboratory on ceramic insulators and dielectrics).

In the final section, Dennis Readey shows how the special nature of clay working and the changing role of engineering in society led to the establishment of a university program in ceramic engineering in 1894 at The Ohio State University. Since that beginning, the rapidly changing role of ceramics in industry and society has required a series of changes in ceramic education. Currently, new materials and new devices, such as those described for glass technology by Kreidl, Uhlmann, and Vandiver, continue to enhance the leverage of ceramic materials in determining the attainable achievements of larger devices and systems. Educators continue to face new challenges.

For studying the continuities and changes of the roles of materials and technology in both archaeological and historical context, ceramics provide a remarkable opportunity that is here fulfilled. Methodologies cover the gamut from experimental archaeology to ethnoarchaeology. The studies described begin with the first fired ceramics made circa 26,000 B.P. and continue on to state-of-the-art optical devices. Archaeological studies illustrate cultural contact and how technological continuity and change have varied from the beginning of ceramic pottery manufacture in the Neolithic to production and use in the Chalcolithic and onto a continuing tradition of blackware ceramics in Mexico. Long periods of continuity and change are evidenced by Greek pithoi and Mesoamerican wares, whereas the sudden demise of an industry is shown for stoneware in the

Indus Valley.

The historical essays presented here, combined with essays in previous volumes of this series, provide us with a reasonably complete picture of the beginnings of modern ceramic science and technology in the eighteenth century, the establishment of non-clay ceramics first as refractories and then toward the end of the nineteenth and beginning of the twentieth century as a child of electricity. There is one example of its developing maturity during World War II. We are presented with a sweeping vision of one field—glass technology—ranging from the ancient Near East to modern optical devices. The parallel changes in ceramic education occasioned by this recent history are just as sweeping.

All in all, the volume represents a major contribution toward understanding our ceramic heritage.

W. David Kingery
Editor

Acknowledgments

In the organization of this volume I should like to acknowledge the co-chairmen of the American Ceramic Society's seminars: Yet Ming Chiang, Paul Johnson, O. J. Whittemore, Wendell Williams, and Pamela Vandiver. Also the invaluable editing skill and assistance of Dorothyanne Peltz, without whom preparation of this volume would have been impossible.

W. David Kingery

Section I

INTRODUCTION

Contents

SECTION I. INTRODUCTION

SECTION II. ARCHAEOLOGICAL STUDIES

SECTION III. HISTORICAL STUDIES

FUNCTIONS AND USES OF ARCHAEOLOGICAL CERAMICS

Prudence M. Rice
University of Florida
Department of Anthropology
1350 Turlington
Gainesville, FL 32611

Interest in the functions and uses of pottery is comparatively new in the history of archaeological and anthropological ceramic studies. This is not to say that scholars have been unaware of the myriad ways ceramic materials have been employed: rather, it has been only recently that considerable investigative effort has been devoted to determining their specific uses. The reasons why this has emerged as a major research focus in the 1980s are not too hard to discern, and I will touch on a few of them below. Parenthetically, it bears mentioning here that Anna Shepard's Ceramics for the Archaeologist[1] treats use and function not at all, providing a framework for analysis of pottery utterly without reference to its cultural context.

Before proceeding further, I would like to discuss briefly some terminology. Cultural items, whether ceramic or other materials, may be studied from a variety of perspectives, among the most common being form, use, function, and meaning.[2] While meaning is beyond the range of the present discussion, the other three are closely related.

Initially it is important to separate "function" from "use." Reference to function is to the broad, generally required activities or capacities of the material, in this case ceramics: it is a series of expectations concerning the role of ceramics in a culture. Two well-known general functions of ceramic materials, for example, are as containers and as structural products. For the remainder of this discussion I will restrict myself primarily to

container rather than structural or ornamental functions, and to pottery rather than to the broader range of ceramics. We can further specify the container functions of pottery as storage, processing, and transport. (I might also note that for archaeologists today pottery has a number of scientific functions and uses: these include dating sites and providing a basis for reconstructions of culture histories, population, trade relationships, etc. Because these are essentially latent rather than manifest functions, not intended by the original makers and users, they are outside this discussion.)

In contrast to function, the use of ceramics has a more specific and active sense of how the material was actually brought into service or employed for a given purpose. Pottery may be used to store grain, cook beans, carry water, etc. The extent to which functions and uses are explicitly identifiable and separable in archaeological contexts is a methodological question of some significance, and is treated by this and the other papers in this volume.

APPROACHES TO FUNCTION

A traditional archaeological approach to studying the function of an object, whether of ceramics or other materials, is by means of its context of recovery. If the pottery is found in household refuse deposits or near residential areas, it is commonly considered to be "domestic" or "utilitarian" in function; pottery recovered from public structures or areas of a site is "ceremonial," while that from burial contexts may be termed either "ceremonial" or "mortuary." The danger in this kind of reasoning is of course that the context of archaeological recovery of pottery is not necessarily the context of its active service. Although a pot recovered from a tomb clearly ended its use-life by being "used" in a burial, it may have had a variety of other uses and functions before this final disposition. In addition, the domestic-ceremonial dichotomy excludes other kinds of uses of pottery containers, for example in a variety of quasi-"industrial" activities such as dairying, salt-making, wine-making, or metalworking.

Ceramic function may be investigated with reference to a number of analytical categories employed in the

study of many archaeological materials. More than 25 years ago, Binford[3] demolished the view of material culture as monolithic "technology," as he differentiated three classes of artifacts on the basis of whether they function primarily in the technological, social, or ideological subsystems of culture:

-- Technomic artifacts have their primary functional context in coping with the physical environment, and variability is explainable largely in ecological terms.
-- Sociotechnic artifacts have their primary functional contexts in integrating individuals and groups, and include symbols of status and authority.
--Ideotechnic artifacts have their primary functional contexts in ideology, symbolizing the rationalizations for the social system and providing the symbolic milieu for enculturation.

Applying these terms to pottery specifically, we might think of cooking pots or storage jars as technomic artifacts, and perhaps certain kinds of serving or ritual vessels (e.g., censers) may be sociotechnic: these latter may be ideotechnic as well. Binford's paper (and later ones) played a major role in changing the course of American archaeology by calling attention to the value of systematic study of variability in artifacts in order to understand and explain how cultures "work." It is largely as an outgrowth of this context-based approach to function that archaeologists have been paying greater attention to uses of pottery, and particularly to the undecorated ceramic materials that had previously been ignored.

Other approaches to function--and perhaps more familiar ones--are based on the form or shape of an artifact. One of these approaches[4] distinguishes primary and secondary functional variability. Primary functional variability is directly related to the specific use of an artifact, for example the presence of a spout or handle on a vessel, while secondary functional variability is a consequence of the social context of the vessel's intended use or of the manufacturers. One problem with this distinction is that it is not clear how "secondary functional variation" relates to what is commonly called "style," which has its own functions in ceramics and other artifacts.[5,6]

Shape is a common starting point for inferring the uses of pottery vessels, and involves consideration of attributes of the vessel orifice, base, body, and appendages. Typically such inferences have reference to terms for modern containers, such as jar, bowl, dish, etc. Unfortunately, however, a wide range of shapes is subsumed within these classes, as for example many different forms may be called a "jar." Beyond primary functional considerations, such as spouts for pouring, several form-related characteristics of pottery can be used to infer suitability for certain uses or activities. These characteristics include the capacity, stability, weight, ease of moving, and closure of the vessel, and accessibility of the contents. Although several studies have attempted to identify specific vessel uses on the basis of form,[7,8,9,10] there is no one-to-one correlation or predictive relationship between variables of use and of form.

Another approach to vessel use is through the composition and physical characteristics of pottery, including its surface treatment. Different clays confer different properties and capabilities on finished vessels, making them more or less suitable for storage, cooking in or over a fire, and other uses. As with shape, there are no clear one-to-one correlations between composition and use, and many interrelated properties play roles here. These include: thickness of the vessel walls; strength, hardness, and resistance to mechanical stress; thermal behavior (especially resistance to thermal stresses); and permeability, porosity, and density. Surface treatment is not directly tied to the composition of the vessel, but surface modifications can affect use-related properties such as permeability, thermal behavior, and ease of carrying. Analysis of many of these properties by means of materials science techniques--and particularly study of mechanical performance characteristics--has become very popular recently, as interest in ceramic use and function has grown.[11,12,13]

In trying to understand the uses of archaeological pottery vessels by analysis of either formal characteristics or mechanical properties, there is a danger of over-determinacy. That is, it may seem possible to conclude that a vessel had a certain use (such as

cooking) because several characteristics (orifice diameter, temper, and thickness, for example) meet the modern engineering expectations for a vessel suited to that activity. Such "function-optimizing" retrodictions are not always justified, however, in part because in creating vessels potters have to make complex decisions about allocating time and resources and minimizing risk that do not necessarily correspond to our modern scientific knowledge of materials performance. We can identify through analysis of ceramic properties what an ancient pot might or might not have been well-suited for, but we cannot prove that those characteristics were intentionally created by the makers for that usage. Nor can we say unequivocally that a vessel was necessarily used in the activities suggested by its performance characteristics. The design principles we as analysts bring to archaeological pottery from modern science and engineering are best considered as a hypothetical "menu" of choices that may or may not be strategically combined by ancient potters to create acceptable products.

The most direct way to tell how a pottery vessel was used is through use-wear and residue analyses. Although this does not necessarily inform on intended function, it can provide information on actual use. (Multiple analyses of many vessels of the same shape would be necessary to determine if that use is a typical mode of service for the category, as opposed to a one-time, idiosyncratic event.) Use-wear analyses of pottery vessels are not as common or as well-developed as are analyses of lithic artifacts, but scratching, abrasion, and pitting of interior and exterior surfaces may reveal eating or processing activities such as stirring, grinding, or fermentation.[14,15] On the exteriors of pots, the amount and placement of fireclouds and soot reveal whether a pot was used in or over a fire, presumably for cooking.[15] The actual contents of a pot may be identified by means of interior residues such as pollen, salts, starches, gums, phosphate,[16] resins,[17] sugars,[18] animal fats,[19] and vegetable oils.[20] Such information is useful to archaeologist in studies of diet, subsistence patterns, trade, and manufacturing activities that involve use of ceramic containers.