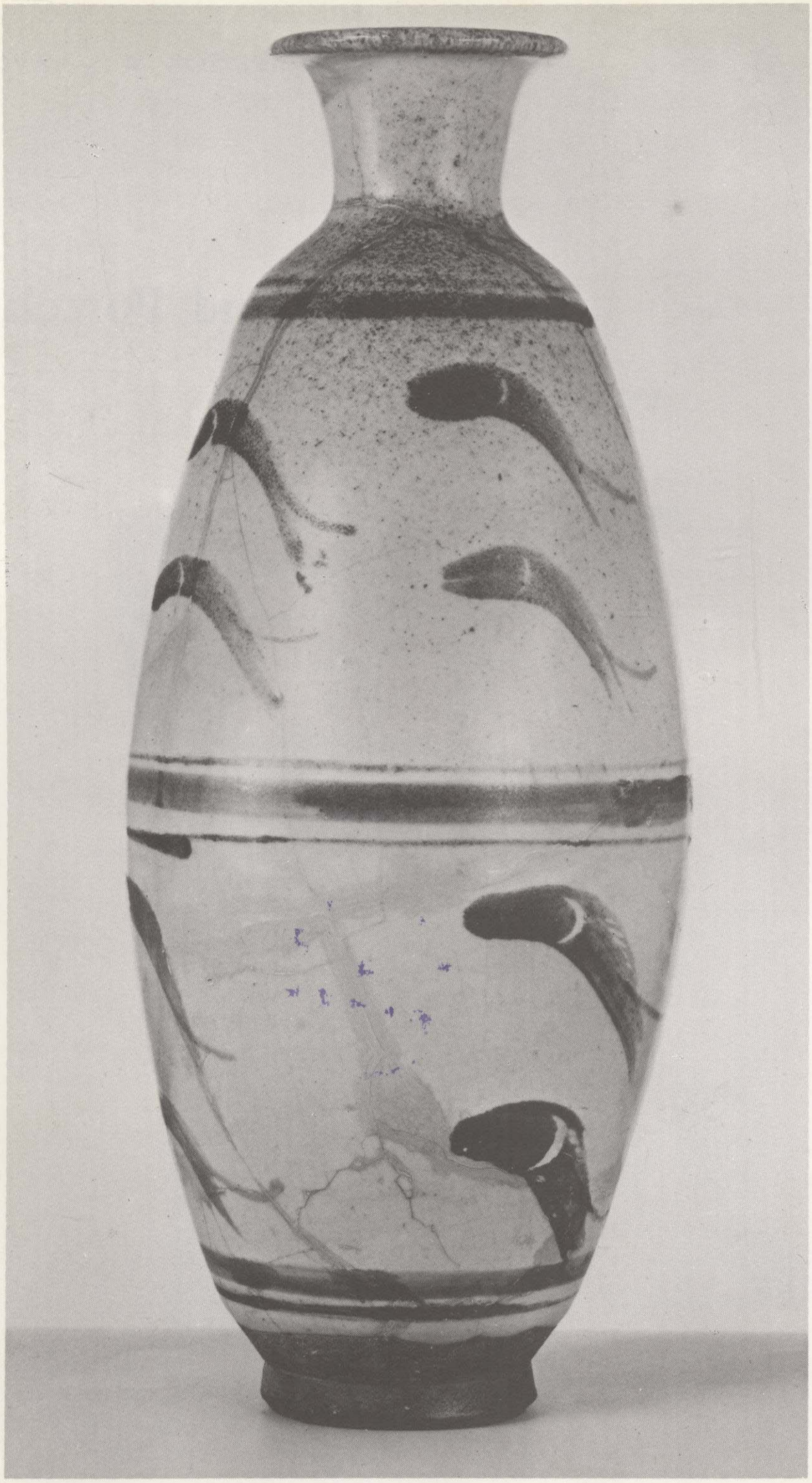
The Thames and Hudson Manual of

Stoneware and Porcelain

David Hamilton   with 115 illustrations, 12 in color

THE THAMES AND HUDSON MANUALS
GENERAL EDITOR: W. S. TAYLOR

Stoneware and Porcelain



David Hamilton

The Thames and Hudson Manual of Stoneware and Porcelain

with 115 illustrations in color and black and white

Thames and Hudson

Frontispiece Vase, 1960, by Bernard Leach (1887–1978)

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Preface

This book is concerned with the art and craft of high fired ceramics. It is also an extension of some of the subjects described in the *Manual of Pottery and Ceramics* where the techniques for hand forming and decorating are discussed in greater detail along with the basic techniques of throwing and firing. This book can be read independently of that particular volume but it is important for the reader to realize that this one is intended for students who already have some experience and understanding of ceramics.

I do not concur with the opinion held in some quarters that stoneware and porcelain are in themselves more advanced subjects, but it is convenient to describe them together with the theoretical side of the science of ceramics, which is usually of concern to those students with some knowledge of the medium who have thereby experienced reactions, either exciting or disappointing, explicable only by understanding some aspects of the science of materials. Some students will prefer to ignore these subjects and remain dependent upon suppliers of ready-made ceramic materials who provide an excellent service for students and professionals alike, but within limits defined by the need to remain profitable. In my working life I have seen many materials previously available disappear from the catalogues and corresponding growth in the volume of ready-prepared materials. This must result in a reduction in the variety of ceramic qualities, and the purpose of increasing students' understanding of the science of ceramics is to release them from a dependence upon the most popular and therefore commercially viable materials and effects.

I would like to thank the staff and students of the Royal College of Art, past and present, for their assistance whilst I was preparing the material for this book, Graham Clark in particular, for allowing me to use some of his photographs of the mould-making process, and Mike Dodd for his generosity and patience in allowing me to photograph him throwing. I would also like to thank Studio House Rosenthal Ltd for granting permission to use a transparency of their porcelain cup, *Century*, reproduced on page 120.

D.H.

Introduction

High fired vitrified ceramics originated in China, Siam and Korea during the Shang Period (10th–3rd century BC) where naturally occurring minerals were found, allowing potters to develop kiln structures and clay bodies suitable for the production of stoneware and porcelain. It is unlikely that this was a rapid change arising from dramatic discoveries; more probably it was a gradual development through increasing firing temperatures and refinements of techniques for shaping, decorating and glazing. Some deposits of china clay or kaolin that are plastic enough to be formed and fired to produce porcelain without modification or addition are known to exist in China and Japan. The search for a refined stoneware or porcelain there was motivated not so much by a desire to achieve a translucent body as by an aesthetic quest for a cold and hard material like jade with a ringing tone when struck similar to that of bronze. This is the reason why so many celadons in various shades of cold colours can be seen in collections of Chinese, Korean and Japanese ceramics.

The art of high fired ceramics is believed to have spread to Japan via Korea during the fifth century BC but porcelain was not produced in Europe until the seventeenth century.

Porcelain formed part of the trade between China and the rest of the known world, particularly the Near East (Persia and Syria), and was carried together with silk from China overland via what became known as the 'silk trade route'. Gradually some of these wares found their way into Europe. The term porcelain is presumed to derive from the Italian *porcella*–small white and translucent sea shell–and to have been introduced by Marco Polo who visited China in the late thirteenth century.

The rarity and refinement of porcelain gave it great value. Not unnaturally there were many attempts to reproduce these high fired wares in the Near East and Europe, but they met with little success. Without the ability to analyze the original material from which Chinese porcelain was made, it would have required a good deal of luck for a Persian or European potter to come across a good quality kaolin as a natural deposit and recognize it for what it was. We now know that kaolins exist within those areas where porcelain was attempted. It was simply not found, or if it was, not recognized at that stage. A soft paste porcelain known as Medici porcelain, however, was produced briefly in Italy around 1580.

By the late seventeenth century in Europe few principalities or kingdoms were without an alchemist seeking to transmute lead into gold and to discover a material from which porcelain could be made. Most of

2 Teapot in soft paste porcelain, Vincennes, *c.* 1750. Victoria and Albert Museum

them realized that the degree of vitrification in Chinese porcelain was similar to that of glass, and it could not have required such a great leap of imagination to perceive that something analagous to glass cullet would be a useful component in a recipe. In 1673 soft paste porcelain for which a glassy flux was used was being made in Rouen. Translucency, whiteness and a high ringing tone when struck were the qualities which European alchemists attempted to reproduce in fine stoneware and porcelain, since collectors did not place the same religious and aesthetic value on their jadelike characteristics.

European attempts to produce porcelain

The invention of the process by which hard paste or true porcelain is made is attributed to J. F. Böttger, a German chemist, who was working in Dresden in 1708 under the sponsorship of the Elector of Saxony, Augustus the Strong. He found a deposit of what we now know as kaolin and from this he was able to make a high fired porcelain, which was developed in Meissen near Dresden. In 1710 there was regular production of this type of ware and by 1720 the composition of the body and its finished characteristics were identical to those of Chinese porcelain.

Kaolin and feldspar had been found in France in 1768 and by the following year there were factories producing hard paste porcelain, in some cases alongside the production of soft paste, but more usually ousting the lower fired composition. Soft paste porcelain tends to have a short maturing firing range. Underfired it is not translucent and overfired it deforms.

Bone ash was being used to replace the glass flux in soft paste porcelain in England in 1750. A patent had been taken out in 1749 for the Bow Factory and Josiah Spode perfected its use at his factory in Stoke-on-Trent around 1805. The product became known as bone china.

Josiah Wedgwood, the eighteenth-century English potter, conducted many experiments in refining the materials, compositions and techniques of ceramics. Included among these developments is jaspar ware which can be regarded as a porcelain although it is usually coloured which renders it opaque. It is composed of clay, kaolin and flint with 50 per cent barium sulphate. He also developed black basalt which is made of a plastic red clay with manganese oxide which colours and fluxes the body.

Parian ware

The manufacture of parian ware, an unglazed bisquit porcelain, was perfected by the company of Copeland and Garret, Stoke-on-Trent, in 1842, and was in general production by 1846. The name derives from the Greek island of Paros, renowned for the quality of the fine textured white marble quarried there. In the early nineteenth century a number of potteries were attempting to produce an unglazed porcelain suitable for the production of small statues, but none produced a material as refined and lustrous. There was considerable competition in England to develop the material and the firing system which was necessary to ensure vitrification without distortion or collapse; the most successful firm in this field was Mintons. Unglazed figures had been produced in European porcelain factories such as Sèvres but these were much more expensive to produce than those made from parian. In 1850 a form of parian was being made which did not depend on total vitrification of the body, but to achieve the silky finish it was vapour glazed and could withstand a second decorative firing. This type of parian was coarser grained than true parian and also cheaper, but when soiled, however, it was difficult to clean. Parian was sometimes coloured with relief decoration in a contrasting colour—*pâte-sur-pâte.*

Salt glazing

Salt glazed stoneware originated in the Rhineland during the late fourteenth century where a tradition of high fired earthenware evolved during the following century. Its use became widespread for all types of ware, including relief decorated tableware. Brown stoneware became known in England at the end of the seventeenth century and a patent for a salt glazing process was taken out by John Dwight of Fulham in 1693. With the development of white and cream lead glazed wares salt glazing came to be associated, in the nineteenth century at least, with cheap containers, bricks and particularly drain-pipes where its resistance to weathering and attack by chemicals made it an obvious choice for engineers responsible for the laying of water and sewer pipes in the rapidly evolving cities of Victorian times.

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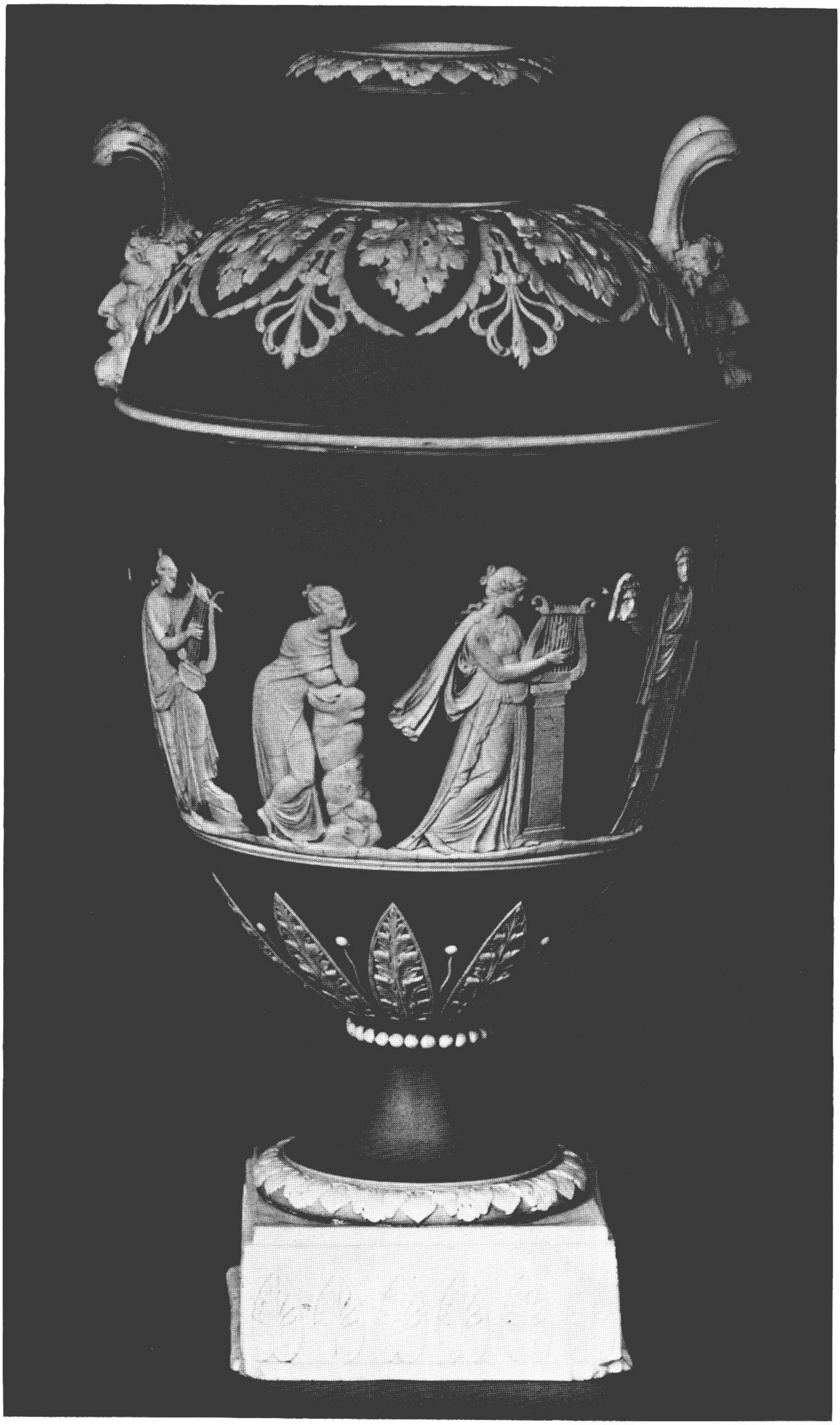
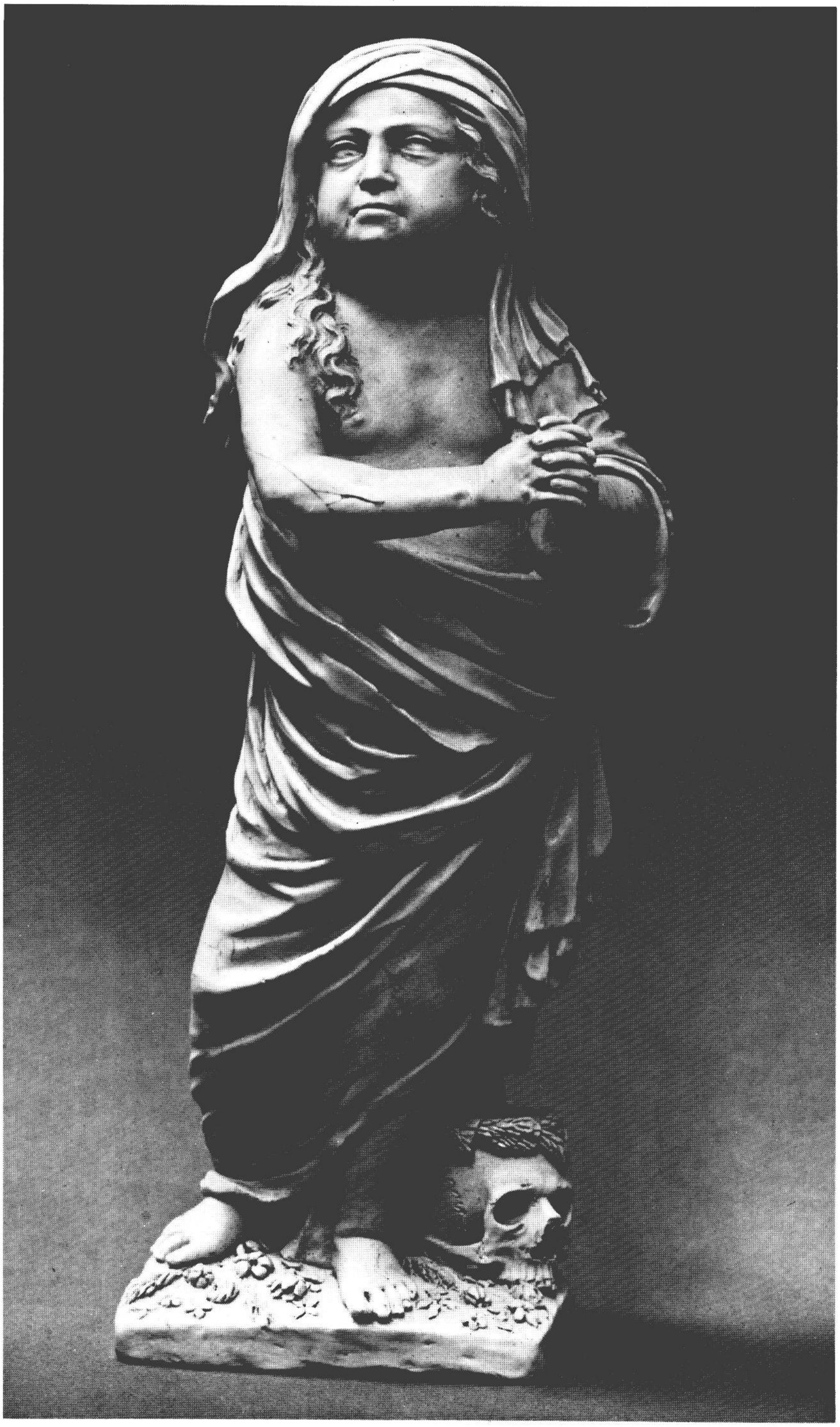


Wedgwood vase by John Flaxman (1755–1826). Victoria and Albert Museum



4 Salt-glazed stoneware figure, John Dwight's Fulham factory, early 18th century. Victoria and Albert Museum

5 Brown salt-glaze spirit flasks from Denby pottery works, founded early 19th century

6 Grotesque face jug by Martin Brothers (from 1873). Victoria and Albert Museum

Sanitary stoneware is a development from white earthenware made by increasing the proportion of feldspar and firing to a higher temperature, thereby achieving a vitrified body.

With the growth of interest in handmade pottery salt glazing has become a favourite technique amongst potters who could build or have access to a salt glaze kiln. The fact that the glaze develops within the surface of the body allows detail modelling to remain unimpaired by a coating of glaze. This is one of the reasons why many salt glazed pots show a preponderance of modelling detail either in the form of relief sprigging or ribs and flutes, all of which are enhanced by the quality and deposition of the sodium in the firing.

During the salting process reduction of the atmosphere takes place within the kiln and this limits the palette of colour; warm browns, orange, blue, grey and white predominate with a glaze texture varying from the characteristic heavy orange peel to a smooth glassy surface.

The process of firing is subject to severe restraint by concern for the amount of hydrochloric acid given off in the form of vapour, which is highly toxic and corrosive. Health and safety regulations have become restrictive and in most localities the production of salt glazed ware is prohibited or subject to control to prevent the escape of toxic gases into the surrounding area.

There has been a move by production studio potters towards the use of soda ash instead of sodium chloride because the former will make a glaze which is similar in many respects to that produced by salt. There is no by-product from toxic gases and salt glazing as such may disappear except for specialist use. If an economic way of neutralizing the hydrochloric acid can be found salting may be reintroduced on a wide scale as it has much to recommend it, both to industry and studio potters.

It is clear that all developments originally depended upon the availability of materials and the gradual improvement of equipment and techniques for refining raw materials. It gradually became possible to identify and modify materials without having to rely solely upon their appearance and pragmatic trials. Similarly this analysis has revealed materials which can be used in ceramics but which had not been part of the traditional ceramic range.

The development of kilns for high firing ceramics was not copied like the style or appearance of ware. But the reawakening of interest in the crafts has encouraged international kiln design with the introduction of oriental types into Europe and America.

Glazes, colours and decorative techniques are aspects of style as well as technique. They must match the firing temperatures of the body although on-glaze colours that were developed in China to decorate white porcelain were also applied to earthenware with little or no alteration.

1 High temperature kilns

Kilns suitable for high temperature firing must use large quantities of fuel or be very efficient in extracting energy from smaller quantities and transmitting that energy to the ware.

The method of extracting maximum energy depends upon the type of fuel. The initial burning of oil and gas requires large quantities of oxygen and to ensure efficient combustion a supply of secondary air must be introduced beyond the burner in the area of the flame. Some energy is lost because the flame has to heat up this secondary air, and efficiency is improved if this air can be preheated by drawing it into the kiln through a passage which is warmed by the firing process.

Burners and fuels

Gas burners: there are two types. The simplest is the atmospheric one which expels the gas into the burner port of the kiln. The system is shown in ill. 7. The gas enters the venturi, a device whereby a stream of one gas entrains another gas (in this case the second gas being air), through a jet which varies in size according to the type of gas, i.e. town (coal gas), natural or propane. The gas entrains air as it passes into the burner pipe and is ignited as it enters the kiln. The resultant flame commences 4 or 5 ins from the end of the pipe which remains relatively cool. Secondary air enters the systems through a specially designed port and ensures that there is an excess of oxygen in the kiln atmosphere so that all the fuel is completely burned. In this system it is the pressure of the gas and the speed with which it leaves the jet which determines the amount of air entrained.

The second one is the forced air type, where the air is supplied by a fan and the gas is entrained by the air. The air and gas are piped to the area where they mix, about 18 ins from the burner and the mixture of air and gas is fed into the kiln through an airtight system.

Forced air kilns require an exit flue for the hot gases, but the draught is established by the pressure of the fan and in most systems the height of the chimney is not critical to the effectiveness of the kiln.

Gas/air mixtures are explosive and must be treated cautiously. In order of calorific value propane is the highest, natural gas less and town gas lowest of all. The amount of gas required to heat a kiln of given volume to a given temperature varies in inverse proportion to the calorific value of gas used.

Atmospheric burners are regulated by controlling the flow of gas only, provided the venturi is not blocked to exclude air and the secondary air

Figure of Kuan-Yin, Goddess of Mercy, blanc-de-chine porcelain. Chinese, early 18th century. Height 15 ins. Salting Bequest, Victoria and Albert Museum ▷

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