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Ceramic investigations in Russia
Scientific approaches, pottery production structure, modern possibilities and some research results

Yuri B. Tsetlin

History and Ceramics Laboratory, Institute of Archaeology of Russian Academy of Sciences, Dm. Ulianov str. 19, Moscow, 117036, Russia
(yu.tsetlin@mail.ru)

This review of Russian investigations into ancient pottery production considers the following three questions: 1) scientific approaches to the investigation of ancient pottery production and their development within archaeology, 2) the structure of pottery production as a functional system and as an object of scientific investigation, and 3) modern research potentials and some results of ancient pottery production investigations in Russia.

Keywords: Ancient ceramics, pottery production, Russia, historico-cultural approach, temper, pottery technology, ethnography

Introduction

This paper is dedicated to a review of some ancient pottery investigations carried out in Russia primarily during the last quarter of the 20th century and in recent years. Certain specific circumstances have led to the need for such a review.

Firstly, most of all the investigations into ancient ceramics in Russia (covering both central and peripheral issues) have been published in Russian and are thus practically inaccessible to foreign readers.

Secondly, a new scientific approach to the study of ancient ceramics and pottery production as a whole which is quite different from the main approaches of foreign scholars has been elaborated in Russia by Alexander A. Bobrinsky during recent decades.

Thirdly, the interest of western researchers in Russian investigations into ancient pottery production has been on the increase on account of presentations at international meetings and many personal discussions and conversations with foreign colleagues.

I would like to consider three main questions here: 1) scientific approaches to the investigation of ancient pottery production and their development in archaeology, 2) the structure of pottery production as a functional system and as an object of scientific investigation, and 3) modern research potentials and some results of ancient pottery investigations in Russia.

Scientific Approaches and their Development

The development of every science is an objective historical process, at the heart of which lies the successive replacement of less effective scientific approaches by more effective ones. Every scientific approach includes the specific notions of scholars regarding the *objects* of investigation, the *aims* of the investigation, and the *modes of interpretation* applied to the information received.

The history of archaeology has lasted about two centuries, and the study of ancient pottery production have come a long way since the early days – from the appearance of the first interest in clay vessels to the construction of complex systems for investigating ancient ceramics as a source of historical information.

In order to consider the history of the creation and development of scientific approaches to ceramic studies and to find out the main regularities governing that

Figure 1. V. A. Gorodtsov and his book "*Russian Prehistoric Ceramics*", Moscow, 1901.

process, it is necessary to know how and why scholars changed their notions on the *objects* and *aims* of investigation, and on the *modes of interpretation* applied to ceramic data (Tsetlin 2001).

Clay vessels are the material results of human activities that included first of all the making of vessels and then their distribution and use. Any purposeful human activity must be *systematic*, because it is only in this way that it can prove successful and provide the necessary living conditions for individuals and cultural groups in their environment. As clay vessels are the result of systematically organized human activity, they ought to contain systematic information about that activity, whereupon the extracting of that information from the ceramics is merely a technical question. It is quite clear that the completeness of the historical information obtained will depend on the efficiency of the scientific research (Bobrinsky 1978).

There have only been three scientific approaches to archaeology in the course of its history:

I. Emotional-Descriptive,

II. Formal-Classificatory,

III. Historico-Cultural.

These approaches can be defined and differentiated principally on the following parameters: a) objects of study, b) scientific tasks, c) modes of interpreting the information extracted, d) main positive aspects, and e) main negative aspects. The attributes that may be taken to characterize the three approaches are presented in Table 1.

The Emotional-Descriptive approach

This approach was established at the beginning of archaeology and was used first in the study of ancient Greek pottery and later in the study of pottery from other cultures. Examples of descriptions of vessels within this scientific approach might include the following: 1) Hvoyko wrote in 1901 about ceramics of the Tripolian Culture from the Aeneolithic Age – "the fine shapes and brave artistic performance of the outlined decoration characteristic of the vessels of group A are entirely absent from the vessels of group B, the decoration on which is more primitive" (Hvoyko 1901:806), 2) Gorodtsov later wrote about the same ceramics – "The most specific feature of it (i.e. the decoration) is a courage and freedom of fashioning" (Gorodtsov 1910:144).

One of the most outstanding research feats of Professor Vasiliy A. Gorodtsov was his *Russian Prehistoric Ceramics,* published at the very beginning of the 20th century (Fig. 1). The book followed the Emotional-Descriptive approach and was dedicated especially to methods required for ceramic investigations. The author reviewed and summarized all the results linked to the earlier development of such investigations and proposed the first general system for ceramic study in the world, which included an analysis of pottery technology, shapes and decoration (Gorodtsov 1901).

Elements of this approach survived throughout the 20th century and have been incorporated into recent archaeological works, too, so that even now we often see descriptive statements such as *weak*, *moderate (average)* or *strong* firing, vessels with *firm* walls and *resounding* sherds, *coarse* or *fine* paste, *careless* decoration, and so on.

It is important to emphasize that the Emotional-Descriptive approach considers a vessel as a holistic cultural phenomenon that includes aspects of technology, shape and decoration.

The Formal-Classificatory approach

This approach began to develop intensively around the middle of the 20th century, although the first attempts at formal descriptions of ceramics were made in the 1930s and 1940s, leading to March's *Standards of Pottery Description* (1934) Brainerd's *Symmetry in primitive conventional design* (1942), and Shepard's *The symmetry of abstract design…* (1948), and followed later by Shepard's *Ceramics for the Archaeologist* (1956). One of the most powerful incitements to the development of this approach was an elaboration of special "codes"

Table 1. The main attributes that may be taken to characterize the different scientific approaches to ancient ceramic data.

	Emotional-Descriptive approach	Formal-Classificatory approach	Historico-Cultural approach
Objects of study	*Obvious morphological features*, first of all shape and decoration, and sometimes other technical details (use of a wheel, types of temper etc.)	– *Formal morphological features* (the height/diameter proportion, surface and fracture colour etc.) and, – *Physical and technical properties* (microhardness, porosity, chemical content etc.)	1) *Features* on the surfaces and in the core of vessels *that mark the potters' methods of manufacture and the inhabitants' methods of use* 2) *Experimental reconstructions of traces of manufacture and use methods*
Scientific tasks	The *visual systematization* and *intuitive sorting* of ceramic materials on the basis of outwardly homogeneous groups of vessels in terms of their shapes and styles of decoration	– *To classify ceramic materials* by reference to their formal features, and thereby, – *To achieve numerical estimates* of the similarity between vessels and groups of ceramic materials	1) *To reconstruct cultural traditions in pottery technology*, shapes of vessels and decoration 2) *Cultural traditions in their distribution and use*
Mode of interpretation	Based on – *Common ethnographic data*, – *Common sense*, and – *Personal experience* of each scholar	A search for the most probable historical explanations for ceramic groups and their similarity	Based on – *Notions* about the systematic nature of cultural tradition, and – *Modern knowledge* about what historical and cultural events and processes are reflected in ancient pottery and how
Positive aspects	The object under study is treated as a *holistic phenomenon*	The opportunity for scholars to produce *detailed and specific data*, and to test the results of the classification	– The *systematic analysis* of the natural structure of the technology, shapes and decoration of clay vessels, – The study of *the behaviour of pottery cultural traditions* in various historical situations
Negative aspects	– The *extreme subjectivism*, and – The *lack of rigorous proof* for the conclusions	– The purely *formal selection of the initial data*, – The *formality of its comparative analysis*, – The *subjective selection of the variants* of its historical interpretation	Not yet been explored

for the formal description of ancient ceramics by J. C. Gardin (Gardin 1976).

This approach represented on the one hand an answer to the defects and subjectivism of the emotional-descriptive approach to ceramic studies, and on the other hand an outcome of the mathematization and formalization process inherent in the natural sciences at that time (first of all in biology). The main effects of this approach were the development of various ceramic "codes" and the wide application of the methods of the natural sciences in general to ceramic studies. A second step in its development was connected with the wide application of computers to archaeology.

Note that in this approach the scholar is left to select from among the main objects of study the ones that "work" (are useful) in a certain historical context and reject those that "do not work" (are useless). It is also very important to note that the results of the

interpretation are imposed on the material by the researcher and are thus deductive rather than inductive.

The most specific feature of the Formal-Classificatory approach is the abandonment of the consideration of pottery as a holistic cultural phenomenon and the use of "attributes" as the main units in the description and analysis of ceramics. Thus a whole object is regarded as a "bundle of attributes", a "ceramic type" as a host of similar "bundles", and so forth.

The Historico-Cultural approach

This approach appeared as a reaction to the extreme formalistic character of ceramic studies. Dissatisfaction with the Formal-Classificatory approach increased after the 1970s and prompted the adoption of a different view of ceramics. Like the Emotional-Descriptive approach, the Historico-Cultural approach considers pots as whole entities, but it also sees a pot as representing a system that embodies the potter's cultural traditions.

The prerequisites of this new scientific approach to ceramic studies had appeared in archaeology long before that, being connected with scholars' attempts to regard ceramics as materialized results of a special form of human labour. Shepard had already used not only the concept of "attribute" but also that of "cultural tradition" when speaking of a set of successive acts of pottery making, while the Dutch researchers H. Franken and J. Kalsbeek, in 1974, were the first to use the concept of a "mixed cultural tradition" when studying Neolithic pottery technology (Franken 1974).

The Historico-Cultural approach was formulated as a system by Alexander A. Bobrinsky in Russia in the late 1970s, in his book *Pottery of Eastern Europe. Sources and methods of study* (Bobrinsky 1978) (Fig. 2).

The new approach was predicated upon data from archaeology, ethnography and experimental work. Archaeological ceramics not only raised a lot of questions for archaeologists which needed further consideration, and increased the spectrum of known ancient pottery traditions but also served as a criterion for verifying theoretical ideas and testing methods for studying pottery production.

Ethnographic data permit us to identify the main scientific ceramic "units" (such as the potters' working skills and cultural traditions) and to ascertain the differences in their behaviour in various historico-cultural situations. Any labour activity (including pottery production) has a system-organized character, because it is only then that it can be successful and preserve the existence of individuals and societies in the world. As

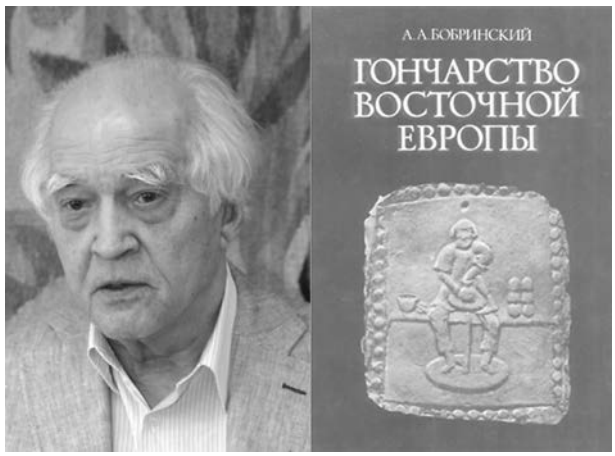

Figure 2. A. A. Bobrinsky and his book "*Pottery of the Eastern Europe*", Moscow, 1978.

ceramic vessels are the result of the system-organized acts of potters, they include all the information on pottery production in a specific form, and this information may be extracted from them. The Historico-Cultural approach has this scientific task as its aim.

The role of scientific experiments is first of all to elaborate reliable and perceptive methods for extracting the necessary system-organized information on the working skills and cultural traditions of the ancient potters. Such experiments are based on preliminary investigations into the technical and other features on the surfaces and in the cores of vessels and on the reconstruction of modes (methods) of pottery making as the reasons of such features. These experiments differ in principle from experiments that rely merely on formal resemblances between experimental and archaeological vessels (Tsetlin 1995). About fifteen years ago Dr. Irina N. Vasiliyeva and Dr. Natalia P. Salugina organized an expedition to perform pottery experiments of kinds which are impossible in the laboratory (Fig. 3–4) and to train post-graduate students from different universities in Russia (Vasilieva & Salugina 1999, 2001).

In general, the role of experiments in the reconstruction of ancient pottery traditions has been growing steadily in recent years (*Experimental Archaeology* 1991, 1992; Glushkov & Glushcova 1992).

The most important feature of the Historico-Cultural approach is *the consideration of ancient clay vessels as a result of the use of concrete pottery skills fixed in specific pottery traditions, which regulate the modes of making, distributing and using pottery employed by the members of an ancient society.*

Figure 3. Experimental expedition. Reconstruction of Fatjanovo's pottery technology (Dr. Helena V. Volkova).

Figure 4. Experimental expedition. Drying of the experimental clay vessels before firing.

* * *

These three scientific approaches characterize three successive levels in the understanding of ancient pottery as a source of historical information. The stages in the development of investigations into ancient ceramics are determined in archaeology by the succession of changes in the existing "scientific paradigm". This succession has a universal character and is based on general regularities in the development of the knowledge process. The regularities lie in progressions: a) from knowledge of the *whole* to knowledge of the *parts;* b) from *intuitive* to *demonstrative* knowledge; and c) from *formal to meaningful* knowledge.

Different combinations of these main knowledge principles form three successive paradigms reflected in three successive stages as both a general and a scientific cognitive process:

Stage I: synthetic knowledge (i.e. holistic, intuitive and meaningful knowledge),

Stage II: analytic knowledge (i.e. partial, demonstrative and formal knowledge),

Stage III: analytic and synthetic knowledge (i.e. holistic, demonstrative and meaningful knowledge).

These three stages characterize the levels of profundity in a scientific cognitive process: level I – *unformed* knowledge, level II – *partly formed* knowledge, and level III – *fully formed* knowledge.

It is thus possible to conclude that research into ancient pottery on the basis of archaeological data is now at the stage of formulating the Historico-Cultural approach to the study of ancient ceramics as a source of historical information and taking the first steps in its practical application. My observations suggest that these three scientific approaches to the study of ancient pottery are typical of both Russian and worldwide theoretical and practical archaeology (Tsetlin 1997, 1999b).

The structure of a Pottery Production System

Before considering the modern possibilities for ceramics investigations, I would like to characterize the general structure of a *pottery production system* and its components as a *real functional system* and as a *source of historical information*.

Both ancient and modern non-industrial pottery production includes three main subsystems. *First*

– pottery is a sphere of material production, *second* – pottery is a sphere of social relations, and *third* – pottery is a sphere of spiritual or intellectual culture.

Pottery as a sphere of material culture consists of four main structural components:

1) *Raw materials* used for pottery making, including their composition and state.
2) *Pottery technology*, i.e. the whole process from the selection of the raw materials to the decoration and firing of the finished vessels.
3) *Pottery tools and equipment* (such as the moulds, potter's wheels, tools for secondary treatment, firing equipment and so on).
4) *Finished vessels* of certain shapes and outward appearances which are the results of the above three components.

These four components are both *necessary* and *sufficient* for the existence of real pottery production.

The sphere of social relations consists of three main components:

5) *Relations between potters*, i.e. relations inside the pottery production system.
6) *Relations between potters and the users of the vessels,* which reflect the distribution of vessels inside and outside certain human groups.
7) *Relations between users of vessels,* which reflect the cultural, ethno-cultural and social structures of human groups that have their own pottery production. Here the relations between the users and the pottery production are of an indirect nature, and consequently they are more difficult to study.

The sphere of spiritual or intellectual culture, includes two components:

8) *Customs and beliefs* touching on raw materials, the making and firing of pottery, tools and equipment for pottery, shapes and decoration of vessels, distribution and use, relations of potters, relations between potters and users, and so on.
9) *Potter's terminology,* which includes specific words and expressions to designate all spheres of the pottery production system.

As it would be impossible to analyse every one of the nine structural components in detail, I would like to emphasize just two important features. *Firstly* – any pottery production system will have all these components (except component eight, the role of which declined during the Middle Age and has been less prominent in later societies that in earlier ones. For example, when I was working with village potters in the 1970s I often saw older potters drawing a cross on the first vessel they made each day, whereas the younger ones would make the sign of the cross but not touch the vessel or would not do this at all. The forgetting of old customs has indeed been a common process in later societies. *Secondly* – no component has closed borders with any other but is a relative part of the single system. Thus, any ancient or recent pottery production will have this unified, permanent internal structure.

The first four components (belonging to the field of material culture) form the *Historico-Technical* direction in pottery studies, while the next five (belonging to the fields of social and spiritual culture) comprise the *Historico-Cultural* direction.

Where historians of technology have ancient pottery production itself as their main interest, cultural anthropologists and archaeologists will consider this production first of all as a source of historical information on human culture and history.

All the above components may be considered *special research objects* in the investigation of ancient pottery production, as each of them includes concrete information about the time when the pottery production in question was a part of actual human culture.

It is obvious that all the components considered here are characterized not only by significant spatial features within the framework of the historico-technical and historico-cultural research directions, but by considerable temporal differences, which reflect their historical development as well. The problems of the evolution of each component of a ceramic culture form the subject matter of a separate *Historico-Evolutionary* direction in pottery studies.

This direction includes *firstly* the study of the *technical and technological evolution* of pottery production (the evolution of raw materials, all the steps in pottery technology, the main kinds of pottery equipment, such as potter's wheels, firing systems and so on, and of vessel shapes and skills of decoration), *secondly* the study of the *social evolution* of pottery production (the evolution of relations between potters, of relations between potters and users of the vessels, and of relations between users), and *thirdly* the study of its *intellectual evolution* (the evolution of potters' customs and beliefs and potters' professional vocabulary).

These form the substance of a ceramic culture as a source of historical information.

Modern Possibilities and Some Results of Ceramic Investigations employing the Historico-Cultural Approach

The following questions will be considered here in the light of the general structure of a pottery production system as an object of investigation.

Alexander A. Bobrinsky proposed in his book *Pottery of Eastern Europe. Possibilities and Methods of Study* (1978) a general system for the technical and technological investigation of ancient ceramics, and developed this system further in later books and in a major paper *Pottery technology as an object of historico-cultural study* (Bobrinsky 1999), see also various papers and books by his followers. The system is based on ethnographic (Fig. 5 – Bobrinsky, 1978:14/15), archaeological and experimental data.

Figure 5. Map of ethnographic pottery production centers whose materials were used in Bobrinsky's book (1978).

The Historico-Technical direction

Raw materials and pottery technology (components 1 and 2)

Bobrinsky divided the whole process into three stages (Preparative, Constructive and Fixative), which included 10 permanent and 2 additional steps, representing the basic technical tasks decided upon and executed by the potters in each act of production. The ways in which these were carried out can differ greatly according to the local environment and cultural traditions.

During the **Preparative stage** the potter provides himself with all the necessary raw materials and adapts them for pottery making.

Step 1 – the selection of raw materials – includes looking for a certain main raw material (clay or silt) and a non-clayey temper. In order to study the potter's skills in this step, the scholar should determine the iron content of the clay, its degree of plasticity, the composition of natural inclusions, and, if possible, the location of a suitable clay source near the settlement. According to the ethnographic data, potters usually emphasize attention to these features with regard to the main raw material (Bobrinsky 1978:73–83, 1999:70).

In antiquity and in recent times potters will have paid particular attention to the selection of an additional temper for the pottery paste. Here, the main question is the distinction between natural and additional inclusions. Gorodtsov put this question forward for the first time as early as 1901 (Gorodtsov 1901:14), since when it has occupied a central place in Russian pottery investigations. There are three groups of temper materials which we can be found in archaeological ceramics: 1) organic materials (such as bird excrement, dung, animal hair, fluff from mire plants, chaff and ash) (Fig. 6a, b, c); 2) organic and mineral materials (broken shells with or without mollusc bodies, broken animal bones) (Fig. 6d); and 3) mineral materials (grog, crushed stone, sand, calcite) (Fig. 6e, f). Various kinds of temper add new qualities to the raw materials. Those of the first group, for example, reduce shrinkage of the clay during the drying and firing of the vessels, those of the second group improve the sintering ability of the sherd during firing, and those of the third group improve the temperature shock resistance of vessels that is common during primitive kinds of firing. But this does not signify that ancient potters used certain kinds of temper precisely in order to achieve these technical effects. The effects of various kinds of temper had been discovered by potters during a long process of experimentation early in the history of pottery production, and later the use of tempers existed only in the form of cultural traditions.

Various investigations have been carried out into the use of silts as the main raw materials (Bobrinsky & Vasilieva 1998), on the use of organic tempers (Bobrinsky 1978, 1989b; Tsetlin 1994, 1996a, 1999a, 2003a, 2003c) and on the use of shell tempers

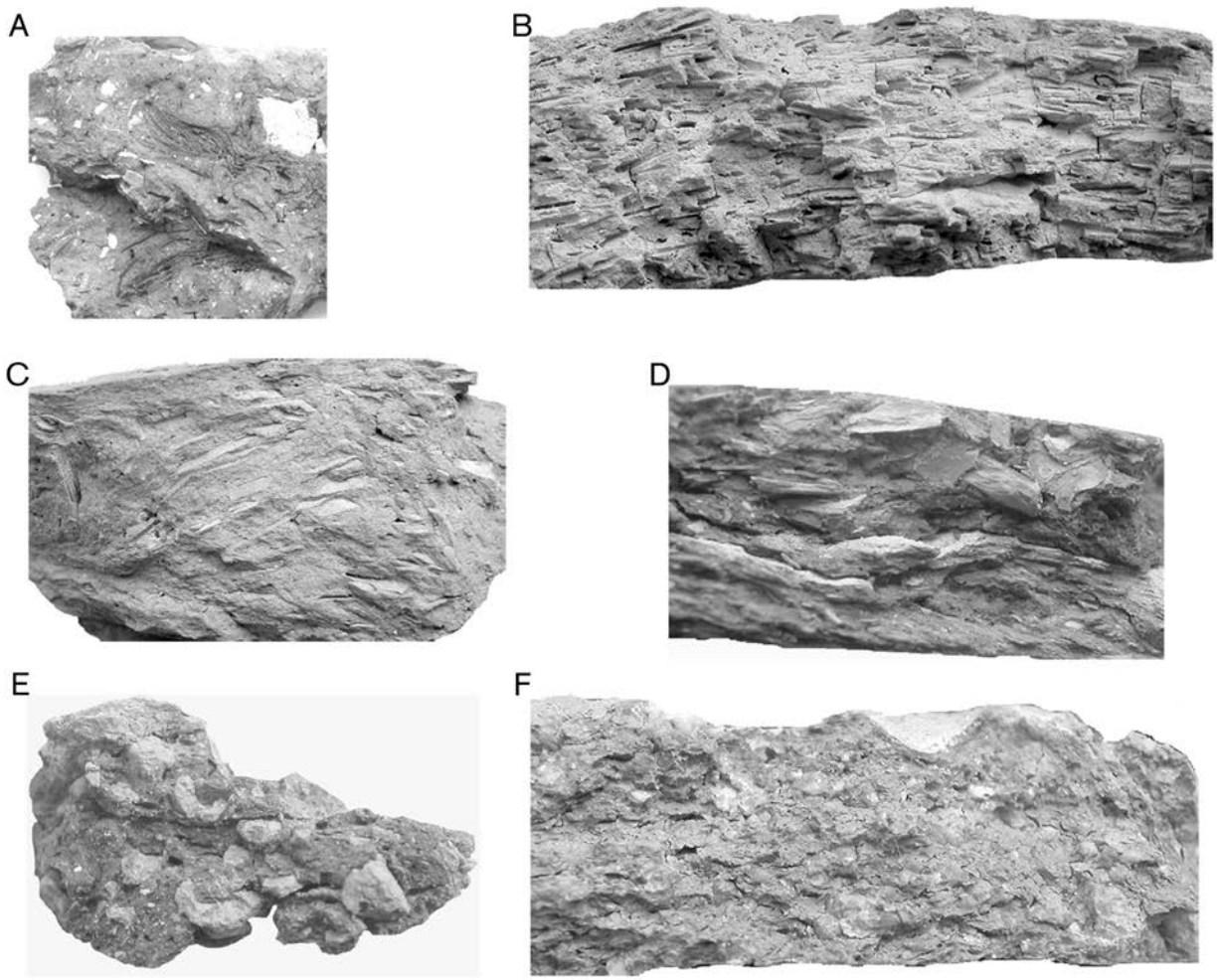

Figure 6. a. Bird's excrements as a temper in Neolithic pottery (Eastern Europe).
b. Dung as a temper in Early Neolithic pottery (Near East),– c. and in Bronze Age pottery (Eastern Europe).
d. Broken shell temper without molluscum's body in Neolithic pottery (Eastern Europe).
e. Grog temper in Neolithic pottery (Eastern Europe), – f. and broken stone temper in Neolithic pottery (Eastern Europe).

(Salugina 1994a).

The study of organic tempers is one of the most difficult problems. An important contribution was made by Bobrinsky, who found out that the use of organic temper by ancient potters was closely related to the origin of the pottery production itself and that vessels with a large quantity of organic temper could be used for the preparation of hot food without preliminary treatment or any special firing. He also established a system of attributes to distinguish certain kinds of temper such as bird and animal excrements and some other organic additions in ancient pottery.

Later, Tsetlin proved that the use of bird excrement as a temper had been characteristic of the hunter–gatherer cultural groups and the use of herbivorous animal dung of cultural groups with an agricultural and/or cattle-rearing background. Thus data on these features can be used to study the early economy of user groups.

Step 2 – quarrying of the raw materials. This step is difficult to investigate by means of archaeological ceramics.

Step 3 – treatment of the raw materials. Ancient potters used very different modes of treatment for both their raw materials and the additional tempers. We can nowadays determine such features of archaeological ceramics as the use of wet, dry or washed types of natural clays, wet and dry organic tempers, broken and unbroken mineral tempers, the sorting of dry tempers through sieves of a certain mesh size, and so forth.

Step 4 – blending of the pottery paste. Here the features of the raw materials used, the kinds of additional tempers, their sizes and their proportions by volume

Figure 7a. Scalding ethnographic vessel (Belorussia). Figure 7b. Blacking ethnographic vessels (Ukraine).

in the pottery paste are related to the skills of the potters. It is important to emphasize that to determine the proportion of temper in a pottery paste it is necessary to know in what condition (dry or wet) the clay was during its preparation.

Since dry broken clay diminishes in volume by an average of 50% upon soaking in water, and the proportion of additional temper will be doubled by comparison with the original situation (Tsetlin 2003c). Pottery pastes composed of clay and one, two or three types of additional temper have been well studied, and it is known that the proportion of temper can vary in the interval from 3:1 to 1:6 by volume (i.e. between 3 parts of temper to 1 part of clay and 1 part of temper to 6 parts of clay).

This step ends the Preparative stage and the next step begins the **Constructive** stage.

Steps 5, 6 and 7 directly reflect the process of vessel construction, which begin with the forming of a "seed-body" (*Step 5*). There are four programmes for doing this: bottom only, from bottom to walls, walls only, and from walls to bottom. *Step 6* then consists of making the "hollow body", the shape that appears after the bottom and walls of the vessel have been formed. The "seed-body" as well as the "hollow body" can be made 1) of a single piece of clay, 2) of patches of clay, 3) of coils, or 4) of strips. Also, separate parts formed of clay can be connected by rings or by coils. *Step 7* involves the shaping of the vessel, which can be done during the making of the "seed-body" and/or the "hollow body", or after them, as a separate technical task. The construction of "seed-body" and "hollow body" and the shaping of the vessels can be done by various techniques: by hand, by beating the clay out with paddle, by throwing on a wheel, or by a combination of these methods. All these details reflect various cultural traditions attached to vessel construction within different cultural groups.

Various modes of making accessory parts for vessels (handles, spouts, supports and so on), as included in Step 11, also belong to this stage as well.

Step 8 – mechanical treatment of the vessel surfaces. A vast range of cultural traditions are available for investigation here. There are many modes of smoothing the surface of a vessel (with the fingers, using grass, fabric, or leather, or with wooden or metal tools), burnishing it (applying to dry or wet clay), or rolling it surfaces by means of carved stamps or stamps covered with fabric, leather, cord or some other material.

The next steps in the processing belong to the **Fixative** stage.

Step 9 – strengthening of the vessel. This can be achieved by "cold", "hot", or "mixed" modes. "Cold" modes include the use of organic tempers which cement the smallest clay particles together and in this way make vessels harder, "hot" modes involve the use of various firing regimes at temperatures approaching red heat, with or without subsequent water hardening, and the "mixed" modes of strengthening are combinations of organic tempers with low-temperature firing regimes. Bobrinsky made a special investigation into low-temperature firing in the 1980s and elaborated a method for studying it on the basis of archaeological ceramics (Bobrinsky 1989a, 1999).

Step 10 – waterproofing. To achieve waterproof clay vessels, potters usually used various liquid fats (such as milk, adipose tissue, or others) which filled the pores in the clay. Archaeological ceramics can also be sealed

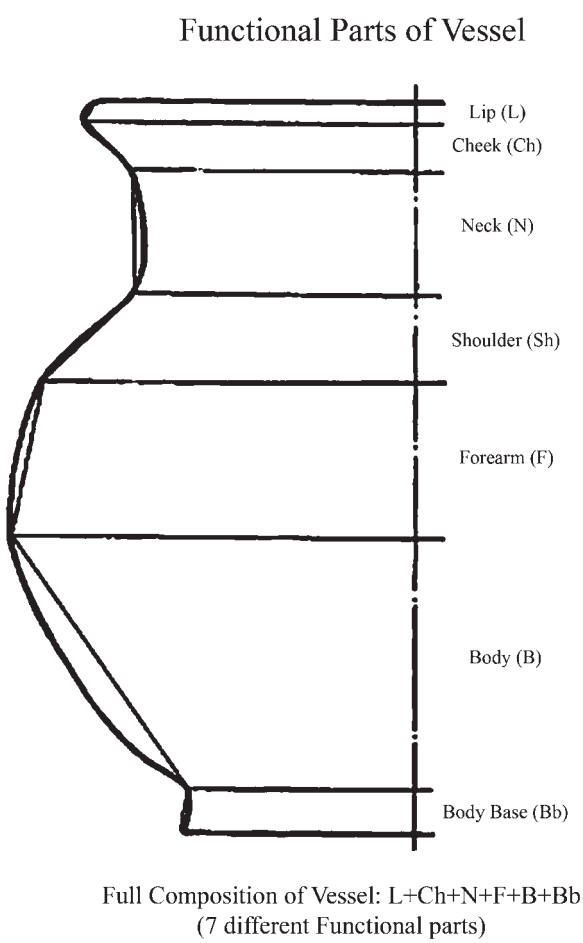

Figure 8. Functional parts of vessel ("skeleton" and "envelopes").

using various forms of "scalding" (i.e. dipping the hot vessel in an organic liquid such as a solution of rye bread or dung) or "blacking" (Fig. 7a–b).

Thus the technical process of making pottery may be viewed as a complex set of successive tasks decided upon variously by the ancient potters. The decisions that were reached were preserved in the cultural traditions specific to different ancient cultural groups.

Russian scholars have been trying to reconstruct these technical traditions during their investigations of ancient ceramics, but the possibilities for studying the various steps in the ancient technical processes still vary greatly.

Pottery tools and equipment (component 3)

The various tools and forms of equipment used for the steps in pottery-making may be reconstructed traces left by them on the surfaces and cores of the vessels, which can be compared with standard laboratory samples of corresponding traces.

Bobrinsky (1962a, b) proposed methods for determining the construction of the potter's wheel from static and dynamic traces of the wheel axes on the bottoms of vessels), and followed this by elaborating methods for studying the smoothing of vessel surfaces with the fingers, using fabrics or leather, or by means of wooden or metal knives, and so on, and also for detecting the beating out of vessel surfaces using flat or embossed paddles, or paddles covered with fabric, skin or cord, for studying the use of moulds (concave or convex) made of various materials (leather, fabric or hair), for reconstructing the stage in the development of the potter's wheel – from a simple turntable to the throwing of a whole vessel from a piece of clay – on the basis of traces left on the ceramics (Bobrinsky 1978). Later on he proposed methods for studying ancient pottery kiln constructions (Bobrinsky 1991b) and ancient bonfire constructions used for firing pottery (Bobrinsky et al. 1993).

In the late 1980s Volkova reconstructed various tools used for graphic pottery decoration by Neolithic potters using material from sites in the Desna river basin (Volkova 1990), and later, during an experimental investigation into the Fatyanovo pottery technology she found that the ancient potters used special convex moulds not only for making the various parts of the vessel body itself but also for making the neck of the vessel. A cord had been used at the same time to take an exact measurement of the perimeter of the neck (Volkova 1998b, 2002).

Vessel shape and decoration (component 4)

Methods for the investigation of vessel shape were elaborated by Bobrinsky in three main directions: a) the study of the general proportionality of vessels, b) the study of the natural structure (or "skeleton") of vessels, and c) the study of the curvilinear lines ("envelopes") of vessels (Fig. 8).

The study of the general proportionality of clay vessels allows five classes to be defined, including three main classes (*high, medium* and *low* vessels) and two intermediate ones (*high/medium* and *medium/low*). Bobrinsky (1984 unpublished; 1999) made it clear that the three main classes characterize unmixed traditions in shaping, while the two intermediate classes reflect mixed traditions that developed through the imitation of vessel shapes belonging to the three main classes.

Various *characteristic points* in the vessel contour can be recognized for defining the shape of vessel's parts, given that every clay vessel can be regarded as a

set of abstract geometrical figures. Bobrinsky was the first to propose what is in principle a new approach to this problem. He found that each clay vessel is a material system resulting from the force exerted by the potter, so that the appearance of any new part in the vessel structure will have been caused by changes in the system related to the personal efforts of the potter himself. The points or narrow zones on the contour where the curved line changes its direction (i.e. where the radius of the vessel's curvature changes) are the places where the potter concentrated his efforts (i.e. where he tried to change the shape of the clay vessel). These places also determine the boundaries of the various functional parts of the vessel and separate them one from another. Also, since the efforts could entail the use of various amounts of strength, the structure of any clay vessel can be viewed as hierarchical, including at least three levels, i.e. the various functional parts can be in an "unformed", "partly formed" or "fully formed" state. As it is difficult to demonstrate these various states of the functional parts without long explanations, I would just like to emphasize that they appear in various aspects of the pottery, the pottery traditions and the pottery production process itself. Such an approach to the investigation of vessel contours permits us to establish different pottery traditions in terms of the creation of shape (Bobrinsky 1987, 1988a, 1988b, 1991a, 1999).

As a result of his study of curved lines in the contours of vessels, Bobrinsky (1991a) elaborated methods for the selection of vessels to be made by young, middle-aged and older potters. The fact is that older potters have a more rigid system of concentrated efforts when shaping vessels than do younger ones, and this is reflected in the curved lines of the vessel. The methods presented by him were elaborated on the basis of ethnographic research.

Volkova (1998a), studying the clay vessels of the Fatyanovo culture from the Bronze Age proposed a method for identifying vessels made by the same potter, assuming a close resemblance in type of clay, temper and technology of construction, and in the use of the same tool for decoration. Based on this work, she concluded that the same potter had made clay vessels of various shapes and with various forms of decoration (but produced in a similar manner).

Volkova (1991, 1996, 1998b) and Tsetlin (1996b) drew particular attention to the general structure of pottery decoration traditions, including a) tools and technology used in decoration, b) style of decoration (or outward imagery) and c) its semantics (or meaning), but most especially tools, technology and style. Tsetlin (1996b) considered pottery decoration to be partly the result of the functioning of a system of notions regarding the external appearance of vessels and characterizing different ancient population groups (the "outer" cultural sphere) and partly the result of specific pottery decoration traditions (the "inner" cultural sphere), and came to the conclusion that especially during the period of pre-market production, the forming of mixed cultural traditions in pottery decoration can be considered to have resulted from mixing between different ancient cultural groups and not only between the potters as the original upholders of those traditions.

Later Tsetlin (2000) established five main directions in the development of pottery decoration traditions, which could be combined in about 15 main modes of decoration making, characterizing unmixed and mixed traditions. Alongside this, he studied the question on the difference between undecorated and decorated ceramics and proposed criteria for distinguishing between "undecorated", "technically decorated", and "purposefully decorated" vessels, the surfaces on which reflect three general stages in development: I – unformed, II – partly formed, and III – fully formed. In some cases these differences are chronological, but in others they are not. For example, there are a lot of cases where Neolithic vessels have a fully formed state of decoration (e.g. vessels of Pit-and-Comb culture in Eastern Europe). But it is probably here that the image used in decoration was adopted as a whole from another field of human culture.

Tsetlin (2006) has recently proposed a general system for the description of graphic pottery decoration, including its location on the vessel surface, types of tools and the modes of their use, internal structure of the styles, and some aspects of the decorative semantics. These cultural traditions are described according to a common succession of nine permanent tasks always decided on by the potters during the process of graphic pottery decoration. There is still a lot of work to be done on the identification of the tools used for this, however, the sequence in which the decorative elements were produced and the position of the vessel during decoration, and more experiments will be needed.

The Historico-Cultural direction

The huge amount of ethnographic material collected by Bobrinsky in the period 1950–1980 from some 1000 country pottery centres in Eastern Europe, including European Russia, the Baltic Region, the

Ukraine, Moldova, the Caucasus and Central Asia became a basis for the elaboration of all the methods directly applied to the historico-cultural interpretation of ancient pottery production data.

Relations between potters (component 5)

Here the main attention was focused first of all on two questions: a) the manner in which working skills and pottery traditions were inherited from one generation of potters to the next, and b) the contacts that existed between potters of the same generation. Other questions not dealt with here concern the invention or adoption of pottery equipment, specialization among potters, and so on.

It has been ascertained that the main way in which potters' knowledge and skills were inherited by the next generations was through the direct training of boys or girls, usually between the ages of 7–8 and 16–17 years. Within ten years they would have mastered all the steps in pottery from the selection of raw materials to the firing of finished vessels by direct copying the actions of an older potter.

According to ethnographic data, the knowledge and skills of potters were still being inherited from father to son or from mother to daughter in 70% or 80% of cases even quite recently (in the 19th and 20th centuries). This percentage could have been even higher in ancient times. If a scholar asked a potter why he was making a pot in a particular way he would answer that this way was how his father had done it and his grandfather before him, and so on, and that this was the only way that would give a successful result. We may thus draw the conclusion that pottery knowledge and skills were inherited in an unchanging state, primarily between relatives. This would, of course, have guaranteed that the pottery traditions were consistent and had a high degree of stability.

But it is well known that *unmixed* and *mixed* pottery traditions were widely spread all over the world. Generalizing from a large amount of ethnographic data, Bobrinsky came to a conclusion of his own regarding the origin of this situation (Bobrinsky 1978, 1999). Any potter, after moving with his family from one place to another, would first begin to look for a clay similar in colour and plasticity to the one he had used earlier. Usually, however, the new clays would have other physical properties, leading to vessels being destroyed during drying and especially firing. But he would know that local potters used these clays successfully. To adapt quickly to the new raw materials he would have to make compromises and use partly his traditional skills and partly skills borrowed from the local potters. As we learn from ethnography, however, he could take part in local pottery traditions only after he had become a full member of the local community, i.e. after he had entered with a family of native potters by marriage. That is why *the mixed technical traditions of pottery may reflect the process of biological mixing among potters*.

Thus an investigation into the ways in which mixed pottery traditions appeared makes it possible to reconstruct actual mixing processes between ancient population groups. Of all the technical traditions, Bobrinsky (1978) discerned in particular the *adopted* traditions, which change over one generation of potters, and *substratum* ones, changing over about five or six generations. When cultural conditions are stable, the technical traditions used in pottery are stable, too, and they can remain in such a state for a very long time. But in a result of cultural contacts between potters with differing technical traditions, mixed traditions appear, most often because the potter's family moves from one place where local pottery traditions exist to another. Mixed technical traditions arise from a change in working skills regarding the raw materials, then in the choice of temper, and later in the treatment of the vessel surface. These are adopted traditions. Other technical traditions, such as the shaping of the vessel, the making of the hollow body and of the seed-body are substratum ones. These characteristics of technical traditions were discerned from the ethnographic database. An analysis of the relative stability of technical traditions in pottery now permits the selection of six successive steps of cultural and ethno-cultural mixing among groups of potters.

Relations between potters and users of clay vessel (component 6)

These relations are first of all determined by the distribution of clay vessels from potters to users. Five types of distribution of handicraft goods can be recognised in human history, characterized by different forms of economy: a) *home-made production*, b) *custom-made production*, c) *craft production with a narrow market area* (radius 1–8 km), d) craft production *with a medium market area* (radius 20–30 km), and e) craft production *with a broad market area* (radius more than 30 km) (Bobrinsky 1978:26). I will not consider here such questions as the study of vessel assemblages, the imitation of vessels, vessel service life and so on.

Using ethnographic data, Bobrinsky (1978) found stable connections between *the economic forms of pottery production*, *the functions of the potter's wheel* (i.e. the abilities of the potter to use the wheel) and *the*

distribution areas of the vessels. The functions of the potter's wheel were related to the extent and power of rotational movement, allowing for four technical tasks: creation of a seed-body, creation of a hollow body, shaping of the vessel and surface treatment. Bobrinsky (1978:27) distinguished seven steps in the development of the potter's wheel (DWF): DWF1 –its use as a turntable for shaping and processing the vessel by hand, DWF2 –use only for part or all of the surface treatment of the vessel, DWF3 –use for the whole surface treatment and for shaping the upper part of the vessel only, DWF4 –use for surface treatment and for the whole of the shaping of the vessel, although the vessel itself is made entirely by hand, DWF5 – use as in DWF4, but also for turning the upper part of the vessel (part of the hollow body), DWF6 –use for turning of hollow body entirely and partly for turning the seed-body, and DWF 7 –use for turning the vessel entirely, beginning with one piece of clay. Home-made and custom-made production in particular was characterized by the 1st, 2nd and 3rd steps, the 3rd step being typical of craft production with a narrow market area, the 3rd, 4th and 5th steps defining craft production with a medium market area, and finally the 5th, 6th, and 7th steps characterizing craft production with a broad market area. Thus, knowing the degree of wheel function, we can approximately estimate the economic forms of pottery production and the areas of vessel distribution.

There is another very important aspect of the relations between potters and the users of vessels. With home-made and custom-made forms of production the vessels usually spread within the same cultural group, in other words, among a related population. In this case *the mixing of various technical traditions reflects not only a mixing of potters but at the same time a mixing of cultural groups as a whole*. On the other hand, the vessels from a craft industry could be distributed both within and beyond the related population, and in this case more caution has to be exercised when arriving at conclusions regarding ethno-cultural processes.

Relations between users of vessels (component 7)

These relations are reflected in the degree of cultural homogeneity in the shapes of clay vessels and their decoration. The users would have been indifferent to the pottery techniques used, but the outside appearance of the vessels would have been very important to them because it was traditional. A lack of cultural homogeneity in a population is usually a result of cultural contacts forming a basis for the conveying of cultural information between groups and thereby increasing their cultural diversity. This diversity may develop through *the use of foreign vessels* and *the making of imitations* of them. In such a situation the potters will be found to use both local and alien traditions. Thus the appearance of mixed cultural traditions in terms of pottery shapes and decoration may reflect a mixing of various cultural groups which used different traditions in these fields. A full circle in the mixing process may be taken to include four steps: *cultural borrowing*, *cultural infiltration*, *cultural integration* and *cultural assimilation* (Tsetlin 1998). Once the process is completed, a new cultural homogeneity may be said to have appeared. The main ceramic changes at each step of such a process of cultural contact have been defined.

Pottery customs and beliefs (component 8)

These are very difficult to study from archaeological data. The main scientific task would appear to consist of collecting and systematizing appropriate ethnographic data, but such work is still only just commencing. Among the specialized works in this field, note should be made of the book by O. Poshivaylo *Ethnography of Ukrainian Pottery Production* (1993).

Potters' terminology (component 9)

This is similarly a topic in which investigations are just beginning. So far I can refer only to a chapter in Trubachev's book (1966) on Slavonic pottery terminology and a part of Bobrinsky's book (1978) in which he makes a comparative analysis of some Slavonic pottery terms and technical data on pottery from the Early Iron Age. The coincidence of these data led him to the conclusion that the ancient Slavs have existed in the central part of Eastern Europe since that time.

The Historico-Evolutionary direction

Only limited results have been achieved in this field as yet. In a few of his works Bobrinsky (1981, 1993b, 1997, 1999) proposed a new hypothesis on the origin of pottery production, at the kernel of which lies a gradual evolution of potters' notions regarding raw materials, tempers and ways of giving strengthening to clay vessels. The history of the origin and development of ceramics consists of several successive stages reflected in various kinds of production: *pre-pottery, proto-pottery, archaeo-pottery*, and *neo-pottery*. The characteristics of these kinds of pottery production are summarized in a generalized form in table 2. It is impossible to quote absolute chronological limits for

Table 2. The Evolution of Pottery Productions.

Kinds of Pottery Production	Raw materials	Pottery paste	Strengthening of vessel
Pre-pottery Production	Silt Bird and animal excrements	60–70% 30–40%	Soaking with various organic solutions. Firing under 470°C (for a long time)
Proto-pottery Production	Silt or clay Organic and/or mineral temper	50% 50%	Firing from 470°C to 650°C (for a short or long time)
Archaeo-pottery Production	Clay Temper	> 60% < 40%	Firing at 650°C and above (for a short or long time)
Neo-pottery Production	Clay or a blend of various clays	100%	Firing at 700°C and above (for a long time or with compound firing)

these stages because their development varied in time from one region to another, but we can note that pre-pottery and proto-pottery were connected first of all with the Neolithic period, archaeo-pottery belongs to the Bronze Age, Iron Age and Middle Ages, and neo-pottery is connected with the making of porcelain and faience wares, which appeared in ancient China and spread from there in the second half of the 2nd millennium AD.

All in all Bobrinsky proposed that about 20 various steps should be recognised in the development of world pottery production.

In the 1990s Bobrinsky (1993a, 1996) formulated a new view of the origin of the pottery wheel, demonstrating that it had not been suddenly invented by somebody but had developed in a natural way through gradual changes in the form of the turntable details brought about by adjusting its pivoting friction during pottery making. The history of potter's wheels themselves only began from the purposeful copying of these changes in detail by ancient potters during the making of turntables. As noted above, the evolution of the pottery wheel itself consists of seven successive steps, reflecting the development and use of its rotational function.

At the same time, Bobrinsky, in cooperation with Volkova and Gey (1993), investigated the evolution of pottery firing structures on the basis of comparative analyses of ethnographic and archaeological data. He discerned successive steps in their development, and proposed attributes to be looked in order to interpret such constructions in archaeological contexts.

In the early 1990, Bobrinsky published a monograph *Pottery Workshops and Kilns in Eastern Europe (based on material from the 2–5th centuries AD)* (1991b), in which he singled out certain characteristics for studying the adaptation of pottery production to favourable and unfavourable economic conditions. These characteristics enabled distinctions to be made between seasonal and all-year-round production regimes and their rise and fall in economic significance to be investigated. The author described the features of bonfire, oven, stove and kiln constructions for pottery firing and elaborated a general classification and evolution of updraught pottery kilns. A detailed investigation of a large number of firing chamber variations allowed him to establish seven successive stages in pottery kiln development. Further analyses of other constructional features then permitted the division of each stage into separate phases and steps in development.

In 2002 Tsetlin proposed a hypothesis for the origin of various modes of graphic decoration on clay vessels, noting that its development was a very long process that had taken place in two directions: towards the making of clay vessels with *technically decorated* surfaces and with *special decorated* surfaces.

The first direction included patterns with a double nature, being on the one hand part of the pottery-making process and on the other creating a stable and identifiable appearance that would distinguish the pottery from that belonging to other cultural groups.

Such a technique marked a *partly formed* state in the development of pottery decoration.

The second direction was characterized by modes of real graphic decoration on the clay vessels. In this case the potter's main task was to give a new image to the vessel surface by covering it with decoration. This technique marked a *fully formed* state in the development of pottery decoration.

The modes of *partly formed* graphic decoration arose within the pottery production itself, but the modes of *fully formed* decoration were partly introduced from another sphere of human culture in a ready-made form (Tsetlin 2002a).

* * *

Another important aspect of ceramic investigations is their potential for serving as source material for the reconstruction of successive "periods" marked by ancient cultural events and processes. This becomes most essential in the case of early periods in human history where narrative and other sources are absent. Nowadays this task is usually entrusted to the natural sciences and is fulfilled especially by radiocarbon dating. The use of such methods is nevertheless hampered by the mixing of archaeological material from different times in the layers found at ancient sites, so that it can be very difficult to attribute a date to a certain archaeological complex.

Since the 1980s Tsetlin (1986, 1988, 1989) has been elaborating a method for reconstructing the cultural stratigraphy of multi-layer Neolithic sites on the basis of ceramic materials. He has proved statistically that ceramic sherds of various sizes had different capabilities for moving up and down in the cultural layers of sites as a result of natural and anthropogenic factors. The larger the ceramic sherds, the more stable their position in the layers, so that large sherds can be taken to mark the levels at which their owners lived on the site. The most reliable stratigraphic picture is given by about the largest 10% of the sherds representing a certain culture. This fact permitted him to propose a new periodization of Neolithic cultures in the forest zone of Central Eastern Europe (Tsetlin 1991), formed firstly by means of a qualitative analysis of the positions of ceramics in the layers at sites, and secondly by quantitative analyses (Tsetlin 1996c, 2003b). Further development of this method allowed him to elaborate the periodization by reference to the pottery decoration traditions of Neolithic populations in the region (Tsetlin 2004, 2008).

Conclusions

Summarizing the results of this review of ancient pottery investigations employing a historico-cultural approach, I would like to note that Russian scholars have studied different pottery traditions from Neolithic and Aeneolithic populations (Gey 1986; Bobrinsky 1989b; Volkova 1990; Tsetlin 1991; Vasilieva 1999), from the Bronze Age (Loman, 1993; Salugina 1994b, 1999; Volkova 1996, 1998b; Gey & Korenevsky 1997; Tsetlin 2002b), from the Early Iron Age (Bobrinsky 1978, 1991b; Lopatina 2002), and from the Middle Ages (Bobrinsky 1962a, 1962b, 1966, 1972; Salugina 1987; Vasilieva 1993; Kirsanov 2000; Boldin 2002, in press). The main object of study has been the ceramics of European Russia and to a lesser degree finds from Kazakhstan, the Near East and other regions, although some aspects of this approach have been used by Russian scholars from Siberia and the Far East (Glushkov & Glushkova 1992; Glushkov 1996; Mylnikova 1999; Grebenshikov & Derevianko 2001; Mylnikova & Chemiakina 2002; Zhushchikhovskaya 2004).

The History of Ceramics Laboratory at the Institute of Archaeology of the Russian Academy of Sciences (Moscow) is now organizing post-graduate training in the methods of ceramic investigations in the framework of the Historico-Cultural approach for archaeologists working on ancient ceramics.

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Literature

Bobrinsky A. A. 1962a. The Pottery Wheel in Ancient Russia. *Soviet Archaeology* No 3, pp. 33–52. *(in Rus.)*

Bobrinsky A. A. 1962b. *Pottery Wheels of Eastern Europe in the 9–12th Centuries*. D.Phil. thesis. Moscow. *(in Rus.)*

Bobrinsky A. A. 1966. On the History of the Pottery Craft in Polesie. *Soviet Archaeology*. No 4, pp. 141–149. *(in Rus.)*

Bobrinsky A. A. 1972. Some Results of Trace Investigations of Ancient Russian Pottery Stamps. *News in Archaeology*, pp.

182–190. Moscow. *(in Rus.)*
Bobrinsky A. A. 1978. *The Pottery of Eastern Europe. Sources and Methods of Study*. Moscow. *(in Rus.)*
Bobrinsky A. A. 1981. At the Origins of the Pottery Art. *Nature* No 4, pp. 118–119. *(in Rus.)*
Bobrinsky A. A. 1984. Domestic Pottery Shapes of the Cherniakhov Culture: Methods of Analysis and Interpretation. Unpublished Manuscript. *(in Rus.)*
Bobrinsky A. A. 1987. On the Method of Studying a Vessel's Shape from Archaeological Excavations. *Cultures of Eastern Europe in the 1st Millennium AD,* pp. 137–157. Kuibyshev. *(in Rus.)*
Bobrinsky A. A. 1988a. The Functional Parts of a Vessel's Shape. *The Problems of Studying Archaeological Ceramics,* pp. 5–21. Kuibyshev. *(in Rus.)*
Bobrinsky A. A. 1988b. Preparation of Pottery Shapes for Analytical Investigation. *Computer's Databanks for Museum and Archaeological Information.* pp. 12–14. Tbilisi. *(in Rus.)*
Bobrinsky A. A. 1989a. On the Method of Investigating the Firing of Ceramics. *First Cuban Archaeological Meeting. Abstracts*. pp. 20–23. Krasnodar. *(in Rus.)*
Bobrinsky A. A. 1989b. Technological Characteristics of Ceramics from Tell Sotto and Kűltepe, pp. 327–334. In *Bader N.O. The Earliest Agriculturalists in Ancient Mesopotamia*. Moscow. *(in Rus.)*
Bobrinsky A. A. 1991a. The Envelopes of Clay Vessels' Functional Parts. *Archaeological Studies in the Forest-Steppe Zone of the Volga River Basin*, pp. 3–35. Samara. *(in Rus.)*
Bobrinsky A. A. 1991b. *Pottery Workshops and Kilns in Eastern Europe (based on Materials from the 2nd–5th Centuries AD)*. Moscow. *(in Rus.)*
Bobrinsky A. A. 1993a. *The Pottery Wheel and its Origin*. Ekaterinburg. *(in Rus.)*
Bobrinsky A. A. 1993b. The Origin of Pottery Production. *Ukraine's Pottery Production*. Vol. 1, pp.39–55. Kiev. *(in Rus.)*
Bobrinsky A. A. 1996. The Origin of the Pottery Wheel. *Ukraine's Pottery Production*. Vol. 3, pp.250–269. Oposhnia, Kiev. *(in Rus.)*
Bobrinsky A. A. 1997. On Structure and Origin of Pottery Technology. *Antiquities. Conceptions. Discoveries. Versions. In memory of Vasiliy Dmitrievich Beletskiy*. Vol. 1, pp. 90–96. Saint-Petersburg–Pskov. *(in Rus.)*
Bobrinsky A. A.1999. Pottery Technology as an Object of Historical and Cultural study. *Actual Problems of Ancient Pottery Investigation (Collected monographs)*, pp. 5–109. Samara. *(in Rus.)*
Bobrinsky A. A., Vasilyeva I.N. 1998. On some Peculiarities of Plastic Raw Materials in the History of Pottery Production. *Problems of North Caspian Basin History*, pp. 193–217. Samara. *(in Rus.)*
Bobrinsky A. A., Volkova H.V., Gey I.A. 1993. Bonfires for the Firing of Ceramics. *Archaeological Investigations In Povolgie*, pp. 3–44. Samara. *(in Rus.)*
Boldin I. V. 2002. *Wheel Ceramics of the Upper Oka River Basin (Problems of Chronology and Periodization)*. D.Phil. thesis. Moscow. *(in Rus.)*
Boldin I. V. (in press). Chronology of the Late Medieval Pottery of the Upper Oka River Basin. *(in Rus.)*
Brainerd G. W. 1942. Symmetry in Primitive Conventional Design, *American Antiquity*. 8, pp.164–166.
Experimental archaeology. 1991. Vol. 1. Tobolsk. *(in Rus.)*
Experimental archaeology. 1992. Vol. 2. Tobolsk. *(in Rus.)*
Franken H. J., 1974. In Search of Jericho Potters. Ceramics from the Iron Age and from Neolithicum. *North-Holland Ceramic Studies in Archaeology*. Vol. I. Amsterdam.
Gardin J. C. 1976. *Code pour l'analyse des formes de poteries, établi en 1956, révisé en 1974*. Paris.
Gey I. A. 1986. Technological Investigation of Ceramics from a Tripolian Site Starue Kukoneshtu. *Institute of Archaeology Short Reports (KSIA)*. No 185, pp. 22–27. Moscow. *(in Rus.)*
Gey I. A. & Korenevsky S. N. 1997. Morphological and Technological Investigation of Ceramics in the Graves of the Kavminvodskoy Group from the Bronze Age. *Historical and Archaeological Almanack Vol. 3*, pp. 6–17. Armavir-Moscow. *(in Rus.)*
Glushkov I. G. & Glushkova T. N. 1992. *Textile Pottery as a Historical Source*. Tobolsk. *(in Rus.)*
Glushkov I. G. 1996. *Ceramics as a Historical Source*. Novosibirsk. *(in Rus.)*
Grebenshikov A. V. & Derevianko E. I. 2001. *Pottery Production of Tribes on the Left Side of the Amur Basin (at the Beginning of the Early Iron Age)*. Novosibirsk. *(in Rus.)*
Gorodtsov V. A. 1901. *Russian Prehistoric Ceramics*. Moscow. *(in Rus.)*
Gorodtsov V. A. 1910. *Domestic Archaeology*. Moscow. *(in Rus.)*
Hvoyko V. V. 1901. Stone Age of the Middle Dnieper River Basin. Proceedings of the 11th Archaeological Congress. Vol. 1. *(in Rus.)*
Kirsanov R. S. 2000. Pottery Production of the Russian Population of Samara's Povolgie Region at the End of the 17th – 20th Centuries. D.Phil. thesis. Izhevsk. *(in Rus.)*
Loman V. G. 1993. Pottery Technology of ohe Population of Central Kazakhstan in the 2nd Part of the 2nd Millennium BC. D.Phil. thesis. Moscow. *(in Rus.)*
Lopatina O. A. 2002. Technological Features of some Ceramics of the Diakovo Culture Population at the Nastasyino Site. *Tver Archaeological Symposium* Vol 5, pp. 494–502. Tver.. *(in Rus.)*
March B. 1934. Standards of Pottery Description. Occasional Contributions, No 3. Ann Arbor: Museum of Anthropology, Univ. of Michigan.
Mulnikova L. N. 1999. *Pottery Production of the Neolithic Tribes of the Lower Amur River Basin*. Novosibirsk. *(in Rus.)*
Mulnikova L. N. & Chemiakina M. A. 2002. Traditions and Innovations in Pottery Production among Baraba's Ancient Tribes. Novosibirsk. *(in Rus.)*
Poshivaylo O. 1993. *Ethnography of Ukrainian Pottery Production*. Kiev. (*in Ukrainian*)
Salugina N. P. 1987. *Pottery Production Technology of the Middle Volga Basin Population in the Early Middle Ages*. D.Phil. thesis. Kuibyshev. *(in Rus.)*
Salugina N. P. 1994a. Shells in the Composition of Ancient Earthen Ware (On the Rise of the Problem). *International Congress on the Application of Natural Science Methods in Archaeology*. Programme. Abstract. II, p. 148. Saint-Petersburg.
Salugina N. P. 1994b. Technological Investigation of Ceramics from the Potapovskiy Cemetery, pp. 173–186. In: Vasiliev I. B., Kuznetsov P. D. & Semenova A. P. (eds.): *The Potapovskiy Mound Cemetery of Iranian Tribes in the Volga River Basin*. Samara University Press. *(in Rus.)*
Salugina N. P. 1999. Pottery Production of the North Caspian Population in the Bronze Age. *Problems of Archaeology of the Volga Basin*. Vol. 1, pp. 116–134. Samara. *(in Rus.)*
Shepard A. O. 1948. *The Symmetry of Abstract Design with Special Reference to Ceramic Decoration*. Publication 574, Contribution 47. Wash.
Shepard A. O. 1956. *Ceramics for the Archaeologist*. Wash.
Trubachev O. N. 1966. Craft Terminology in the Slavonic Languages (Etymology and an Attempt at Group Reconstruction). Moscow. *(in Rus.)*
Tsetlin Y. B. 1986. On the Method of Ancient Ceramics Periodization. *Problems of the Neolithic in the Forest and Forest-Steppe Zones of Eastern Europe. Abstracts*. pp. 48–50. *Orenburg. (in Rus.)*
Tsetlin Y. B. 1988. On the Reconstruction of the Archaeological Stratigraphy of Neolithic Sites. *Soviet Archaeology No 1*, pp. 5–16. *(in Rus.)*
Tsetlin Y. B. 1989. On the Problem of the Periodization and Chronology of Archaeological Cultures (from Ceramic Materials). *Ceramics as a Historical Source*, pp. 70–92. Novosibirsk. *(in Rus.)*
Tsetlin Y. B. 1991. *Periodization of the Neolithic in the Upper Volga*

River Basin. Methodological Problems. Moscow. *(in Rus.)*

Tsetlin Y. B. 1994. Some Cultural Traditions in the Pottery Production of Tribes with Hunting-and-Gathering and Productive Economies. In: Palaeodemography and Migratory Processes in Western Siberia from Antiquity to the Middle Ages. International Scientific Conference. Abstracts, pp. 16–18. Barnaul. *(in Rus.)*

Tsetlin Y. B. 1995. Problems of Scientific Experiments in Ancient Pottery Studies. *Russian Archaeology* No 2, pp. 59–68. *(in Rus.)*

Tsetlin Y. B. 1996a. Cultural Traditions in Pottery Production as a Source of Information on the Most Ancient History of Productive Economy and their Owners (Methodological Problems). *Humanitarian Science in Russia: Soros's Laureates.*, pp. 305–312. Moscow. *(in Rus.)*

Tsetlin Y. B. 1996b. General Principles of the Decoration of Ancient Pottery (First Step to Addressing the Problem). *Tver Archaeological Symposium, 2*, pp. 39–49. Tver.. *(in Rus.)*

Tsetlin Y. B. 1996c. The Periods in the History of the Early Neolithic in the Upper Volga Region (based on Ceramics Investigation Data). *Tver Archaeological Symposium* Vol. 2, pp. 155–163. Tver. *(in Rus.)*

Tsetlin Y. B. 1997. Main Directions and Approaches in the Study of Ancient Pottery Technology Abroad. *Russian Archaeology* No.3, pp. 83–92. *(in Rus.)*

Tsetlin Y. B. 1998. Cultural Contacts in Antiquity (Their General Systematics and Reflection in the Cultural Traditions of Potters). *Tver Archaeological Symposium. Vol. 3. Tver*, pp. 50–63. *(in Rus.)*

Tsetlin Y. B. 1999a. Main Directions and Scientific Approaches in the Investigation of Organic Tempers in Ancient Ceramics. *Actual Problems of Ancient Pottery Investigation (Collected monographs)*. Samara, pp. 110–140. *(in Rus.)*

Tsetlin Y. B. 1999b. Scientific Approaches in the Study of Ancient Ceramics. *The Old Potter's Almanack*, vol. 7, No. 3, pp.5–8.

Tsetlin Y. B. 2000. Criteria for the Distinction of Ornamented and Non-Ornamented Earthen Wares. *Tver Archaeological Symposium,* Vol. 4:I, pp, 251–259. Tver. *(in Rus.)*

Tsetlin Y. B. 2001. Evolution of Scientific Approaches to Ceramic Studies in Archaeology. *Ancient Craftsmen in the Urals Region*, pp. 54–75. Izhevsk. *(in Rus.)*

Tsetlin Y. B. 2002a. The Origin of Graphic Pottery Decoration (The Rise of the Problem). *Tver Archaeological Symposium. Vol. 5*, pp. 231–240, Tver. *(in Rus.)*

Tsetlin Y. B. 2002b. The pottery kiln at Tell Hazna I and its position in kiln evolution. Ceramics from the kiln. In V. Killikoglou, A. Hein. & Y. Maniatis (eds.): *Modern Trends in Scientific Studies on Ancient Ceramics. Papers presented at the 5th European Meeting on Ancient Ceramics, Athens 1999*, pp. 85–94. BAR International Series 1011. Oxford.

Tsetlin Y. B. 2003a. Ancient Pottery Traditions in Tribes with Hunting and Gathering and Productive Economies. *The Old Potter's Almanack* v. 8, No. 2, pp. 4–6.

Tsetlin Y. B. 2003b. An Attempt at a Numerical Approach to the Relative Chronology of Neolithic Cultures in the Upper Volga Region. *Russian Archaeology* No 4, pp. 36–45. *(in Rus.)*

Tsetlin Y. B. 2003c. Organic Temper in Ancient Ceramics. *Ceramics in Society. Proceedings of the 6th European Meeting on Ancient Ceramics,* pp. 289–310. .Fribourg.

Tsetlin Y. B. 2004. Local Features in the Periodization of the Pit-and-Comb Culture in the Upper Volga Basin (Methodological Problems). *Russian Archaeology* No 4, pp. 8–23. *(in Rus.)*

Tsetlin Y. B. 2006. On the Elaboration of a System for Describing Graphic Pottery Decoration. *Tver Archaeological Symposium* vol. 6:1, pp. 316–327. Tver. *(in Rus.)*

Tsetlin Y. B. 2008. The Centre of the Russian Plain in the Neolithic Age. Decoration of Clay Vessels and Methods for the Periodization of Cultures. Tula *(in Rus.)*

Vasilieva I. N. 1993. *Pottery Production in the Bolgarian part of the Volga Region in the 10th–14th Centuries.* Ekaterinburg. *(in Rus.)*

Vasilieva I. N. 1999. Pottery Production of the North Caspian Population in the Neolithic. *Problems of the Archaeology of the Volga Basin*. Vol. 1, pp. 72–96. Samara. *(in Rus.)*

Vasilieva I. N. & Salugina N. P. 1999. Experimental Methods in the Investigation of Ancient Pottery Production (On the Problem of Elaboration of a Research Structure by means of Physical Modelling). *Actual Problems of Ancient Pottery Investigation (Collected monographs)*, pp. 181–198. Samara. *(in Rus.)*

Vasilieva I. N. & Salugina N. P. 2001. Experiment, Forming Techniques, and Ancient Pottery. *The Old Potter's Almanack* Vol. 9, No 3, pp.1–2.

Volkova H. V. 1990. Cultural Traditions of Neolithic Pottery Production: Using Material from the Desna Expedition. *Institute of Archaeology Short Reports (KSIA).* No 201, pp.39–48. Moscow. *(in Rus.)*

Volkova H. V. 1991. The historical and cultural approach to studying ancient pottery decoration. *Ceramics as a Historical Source (Approaches and Methods of Study). Abstracts*, pp. 31–34. Kuibyshev. *(in Rus.)*

Volkova H. V. 1996. *Pottery Production of the Fatjanovo Tribes*. Moscow. *(in Rus.)*

Volkova H. V. 1998a. Ancient Pottery Produced by the Same Maker (Selection and Analysis). *Tver Archaeological Symposium* Vol. 3, pp. 135–146. Tver. *(in Rus.)*

Volkova H. V. 1998b. *The Ceramics of the Volosovo-Danilovo Fat'yanovo Cemetery as a Historical Source.* Moscow. *(in Rus.)*

Volkova H. V. 2002. The Role of Experiment in Reconstruction of the Fatjanovo Pottery Technology. In by V. Killikoglou, A. Hein & Y. Maniatis (eds.): *Modern Trends in Scientific Studies on Ancient Ceramics. Papers Presented at the 5th European Meeting on Ancient Ceramics, Athens 1999*, pp. 95–102. BAR International Series 1011. Oxford.

Zhushchikhovskaya I. S. 2004. *Essays on Prehistoric Pottery-Making in the Russian Far East*. Vladivostok. *(in Rus.)*