

Patterns of Multi Linear Evolution in Pottery Production

Yu.B. Tsetlin*

Institute of Archaeology of Russian Academy of Sciences, Moscow, Russia

**Corresponding Author: Yu.B. Tsetlin, Institute of Archaeology of Russian Academy of Sciences, Moscow, Russia.*

ABSTRACT

The article deals with main patterns of evolution of different sides of pottery production which is regarded as specially organized functioning system having concrete inner structure and certain connections with the outer world. The systemic nature of pottery is determined by the systemic character of any human goal-directed activity which is expressed in cultural traditions passed down to succeeding generations. The author regards modern data on the development of vessel shapes, their decoration, main plastic raw material, pottery paste, techniques of vessel construction, potter's wheel functions, ways of pottery firing and devices for firing. The development of these sides of pottery can be seen on three qualitatively different levels: macroevolution, mesoevolution, and microevolution

Keywords: *evolution, shape, decoration, technology, potter's wheel, firing devices*

INTRODUCTION

The article is dedicated to the issue of some patterns of evolution in ancient pottery and its production. It has become possible thanks to the fundamental research by A.A. Bobrinsky in whose works this problem became a subject of special research (Bobrinsky 1978; 1991; 1993a; 1993b; 1997; 1999; 2006; Bobrinsky, Volkova, and Gey 1993; Bobrinsky and Vasilieva 1998; Tsetlin 2010). It was partly developed in his followers' works. (See, for example, Tsetlin 2002a; 2006; 2013; 2018a; Vasilieva 2009).

Before turning to the issue of evolution of different sides of pottery production we have to clarify what precisely this production is, what its inner structure is like and how it is connected with other sides of social life. It's known at the moment that pottery production (both ancient and modern) is a complicated specially organized system with certain structure (Tsetlin 2005; 2012, 39-41) including three subsystems each of which consists of several components.

Subsystem1: The sphere of production unites 1) raw material, 2) technology, 3) techniques and 4) finished products.

Subsystem2: The sphere of social relations includes 5) relations between potters, 6) relations between potters and users and 7) relations between pottery users.

Subsystem3: The sphere of spiritual culture encompasses 8) customs and beliefs in pottery

and 9) terminology used by potters and pottery users.

Such an access enables to formulate certain properties of pottery as a special system. Firstly, there are internal connections between components of the system which form its permanent structure. Obviously connections inside each of the three subsystems are stronger than between components belonging to different subsystems. Secondly, there are external connections: first three components of the first subsystem have a consistent link with the natural environment which makes possible the production and subsystems two and three (entirely) and component 4 of the first subsystem provide a strong link between pottery and a society of which potters are members.

In such a way three types of links (inside the system, with the natural environment and the society) are essential to successful functioning of the whole system of pottery production.

First we'll try to find out what data we can rely on researching the evolution of pottery. Probably, we can speak about three groups of data. Firstly, it's currently known chronological sequence of different objects of pottery. Secondly, there are numerous ethnographic data on different sides of pottery production. Evaluating these groups of data we are first of all obliged to note their information incompleteness that is they don't give enough material for studying evolution of all components and all aspects of the pottery system

Patterns of Multi Linear Evolution in Pottery Production

m. We have to use random and in large part fragmentary facts from different periods received from different regions of the globe and on this basis try to reconstruct the line of evolution of some sides and objects of pottery. That alone makes such a reconstruction largely speculative.

The lines of evolution in pottery are currently being researched with varying degrees of detail for the following sides of it:

- evolution of vessel shapes
- evolution of decoration
- evolution of main plastic raw material
- evolution of pottery paste
- evolution of vessel construction techniques
- evolution of potter's wheel functions
- evolution of ways of pottery firing
- evolution of technical devices for firing

RESULTS

The Evolution of Vessel Shapes

It is obvious that clay vessels appeared in human society to meet certain needs of people. In some cases they were the needs which were previously met with vessels made of other materials (stone, wood, bark, shells, pumpkins, skins, manure etc.), in others some new human needs (for example, for fire cooking), which nonclay vessels could meet only to a limited extent.

The exceptional variety of clay vessel shapes appeared as a result of a number of factors. Firstly, the shape of clay vessels was influenced by the shape of their nonclay prototypes. For instance, in the Middle East flat-bottomed clay

vessels were preceded by rather wide spread flat-bottomed stone and wooden vessels (Tsetlin 2012, 262-267). Secondly, growing variety of human needs led to broader production line of vessels with different functions. In particular, rather limited variety of Neolithic vessel shapes in the forest zone of Eastern Europe compared to vessels of the Hassuna culture in northern Mesopotamia can be accounted for both less diversified needs and extensive use in the forest zone of vessels made of other material (water bags, wicker containers etc.) along with clay vessels. Thirdly, growing variety of human needs was met as well thanks to the development of natural structure of shapes and changes in general proportionality of vessels. This can be seen on the one hand in dissemination along with simple in their natural structure 3-4- part shapes of more complex 5-6-7- part vessel shapes, and on the other hand in distribution of vessels which differ in their general proportionality: bowl-like (or low), pot-like (or medium), jug-like (or high) shapes and a lot of intermediate forms (Tsetlin 2018b). Finally, fourthly, cultural contacts and mixing population groups with different traditions in this sphere had a major impact on a growing variety of vessel shapes (Bobrinsky 1999, 53-56; 2018b).

Besides these factors some changes in certain peculiarities of shapes were influenced by random fluctuations inevitable in the process of vessels reproduction and connected with physiologic characteristics of potters' labour. Generalization of all factors set out above reveals that main patterns of the evolution of clay vessel shapes can be examined at three levels.

At the level of macroevolution of clay vessel shapes it is possible to highlight 4 stages (Fig. 1):

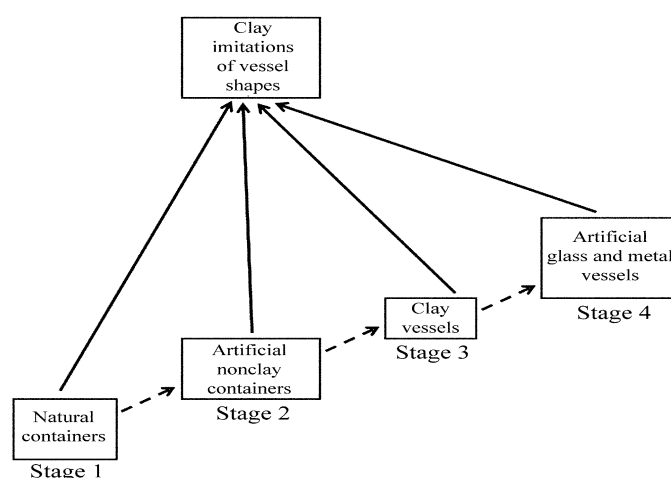


Fig1. Macroevolution stages of clay vessels' shape

Stage1: Imitation of finished natural containers (Fig. 2)

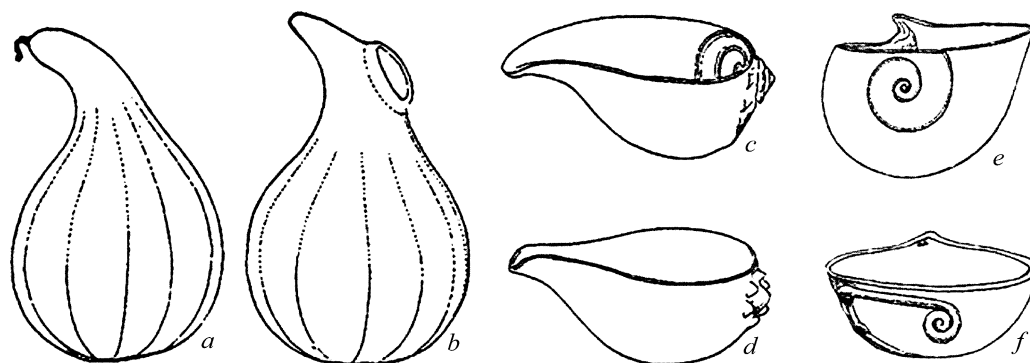


Fig2. Patterns of natural capacities and their imitations made of clay: a – gourd, b – clay vessel (Holmes, 1883b, p. 446, fig. 464: a, b); c, d – shells, e, f – clay vessels (Holmes, 1883a, p. 384, fig. 375; 1883b, p. 447, fig. 465a, b; p. 454, fig. 475: a, b)

Stage2: Imitation of artificial stone, wooden and wicker containers (Fig. 3)

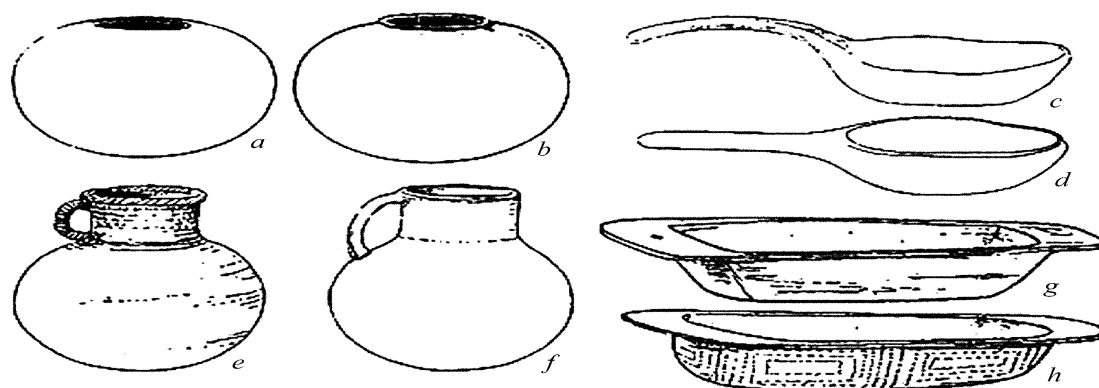


Fig3. Patterns of artificial nonclay capacities and their imitations made of clay: a – stone vessel, b – clay vessel (Holmes, 1883b, p. 448, fig. 466); c – horn spoon, d – clay spoon (Holmes, 1883b, p. 448, fig. 468); e – wicker vessel, f – clay vessel (Holmes, 1883b, p. 449, fig. 470, 471); g – wooden tray, h – clay tray (Holmes, 1883b, p. 448, fig. 467: a, b)

Stage3: Imitation of artificial clay vessels (Fig. 4)

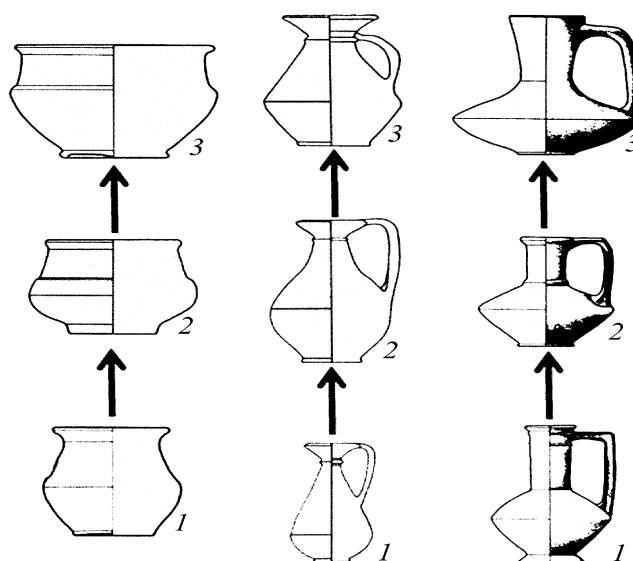


Fig4. A set of Chernyakhov clay vessels' imitations, the numbers indicate a sequence of the imitations (Bobrinsky, 2018. P. 87. Tabl. VIII; P. 105. Tabl. XIII; P. 115. Tabl. XVI)

Stage4: Imitation of metal and glass vessels (Fig. 5)

Patterns of Multi Linear Evolution in Pottery Production

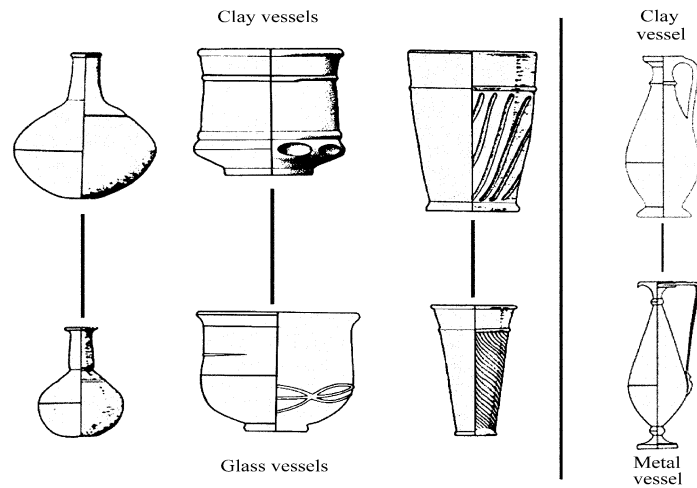


Fig5. Chernyakhov clay vessels' imitations of glass and metal vessels (Bobrinsky, 2018a. P. 91. Tabl. IX; P. 102. Tabl. XII; P. 109. Tabl. XIV; P.115. Tabl. XVI)

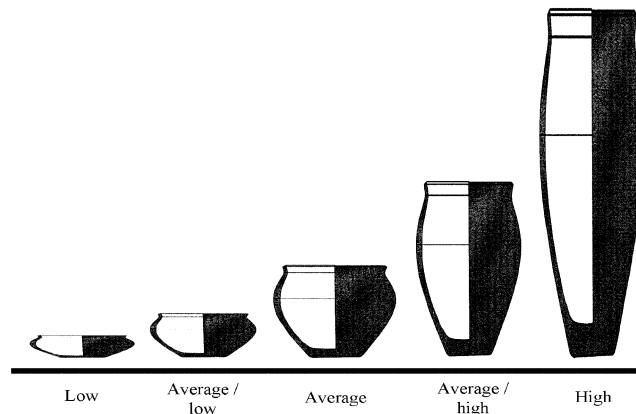


Fig6. Differentiation of vessel shapes by their general proportionality

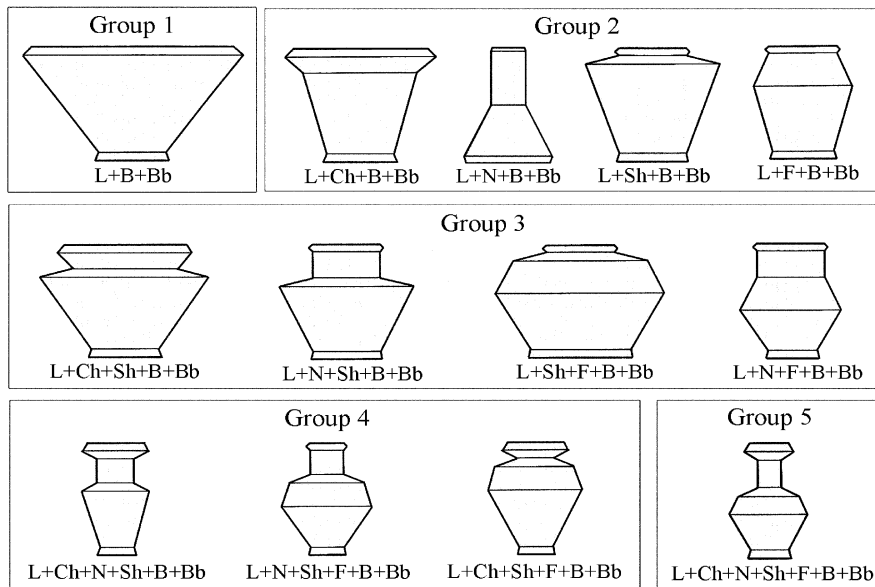


Fig7. Differentiation of vessel shapes by their natural structure (L - lip, Ch - check, N - neck, Sh - shoulder, F - forearm, B - body, Bb - body base)

The *macroevolution* level which exists in two processes: *differentiation* and *universalization* of vessel shapes. Differentiation of vessel shapes occurs in a) their general proportionality (**Fig. 6**),

b) development of their natural structure, i.e. broader production line (**Fig. 7**), c) dimensional characteristics of vessels. All these trends are related to vessels' specialization according to

Patterns of Multi Linear Evolution in Pottery Production

their functions. The process of universalization becomes apparent in gradual blurring of cultural and ethnocultural distinctions between different groups of population.

The *mesoevolution* level. Here the development of vessel shapes is influenced by various cultural contacts. Two main types of such contacts are known. The first of them - it's when a local potter reproduces usually on order a vessel new for him as a rule more complex and prestigious from another culture. In this case there appear so called imitative vessels which have syncretical character. The second type is connected with the mixing of bearers of different traditions in shaping vessels as a result of potters' migration to a different cultural environment. In the process either the relationship of *dominance* and *recessivity* arise between local potters and the newcomers as a result of which recessive (subject) traditions are progressively eliminated either partially or fully or both groups of potters gradually occupy different production niches i.e. for instance some of them specialize in cookware and others in tableware.

The level of *microevolution* is manifested in progressive change of vessel shapes during lifetime of a single potter or 2-3 generations of potters connected by the "teacher-apprentice" type of relationship. At this level so called *ageing image* mechanism acts. It is manifested in the fact that making traditional shapes any potter has always his previous vessel as a mental model. But since every consecutive vessel is slightly

different from the previous one during the lifetime of one generation these accidental (unconscious for the master) differences gradually accumulate. That's why vessels made by a master at an advanced age when his skills are more stable differ markedly from those made in his younger days (Bobrinsky 1991a, 17-20; 2018a, 54-59). This is the modified image that he passes on as a model to his apprentice that is to the potter of the next generation. Then this process is repeated leading to growing distinction between vessel shapes made by different generations of potters.

The Evolution of Pottery Decoration

Decoration on clay vessels is preceded by a long history of its development on other material objects. It doesn't mean that all types of decoration were formed outside pottery; some of them emerged inside of it.

When the process of making a vessel is completed its surface can be in two states: technologically non-relief and technologically decorated. In the first case the vessel has a *smooth* surface without any noticeable relief and is a "potential field" for making decoration borrowed from other spheres of culture. In the second case at the stage of shaping a vessel and mechanical treatment of its surface it undergoes coarse smoothing and beating with a relief paddle etc.

In such a way at the level of *macroevolution* two main stages are known in the development of pottery decoration in the history of pottery (**Fig. 8**):

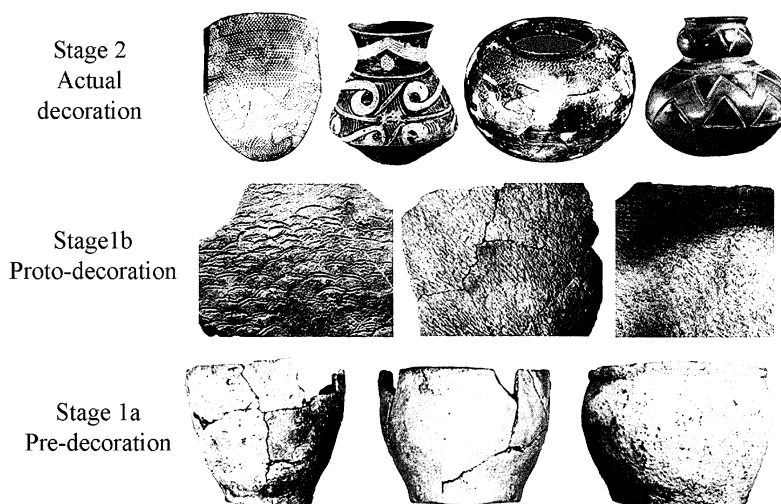


Fig8. Macroevolution stages of pottery decoration

Stage1a: pre-decoration – a flat natural condition of the vessel surface (“without decoration” state)

Stage1b: protodecoration – a relief technologically decorated state of the vessel surface (example)

Stage2: actual decoration – implies special creation of a new outlook of the vessel surface. At least two stages can be distinguished here: the earlier when people become aware of semantic significance of decoration and the later when this

knowledge is getting lost and decoration gains esthetic importance.

At the level of *mesoevolution* the development of pottery decoration occurs through mixing of traditions of different ethnocultural groups including imitation of pottery models from other cultures. There is a dramatic increase in decoration variety in this period which then under the influence of dominant traditions gives way to gradual formation of a new cultural homogeneity. Therefore at this level the evolution of decoration has a *pulsating* character (Tsetlin 1991, 115).

The level of *microevolution* of decoration so far can be spotted for the period previous to handicraft production when it reflects mixing of these traditions between different lineage groups within single ethnocultural collective (Volkova 2017).

The Evolution of Main Plastic Raw Material

The use of natural plastic raw material for making vessels is based on a long acquaintance with its *properties* in the aceramic period. The silty raw material of complex composition (valley silts and mountain silts) turned out to be the most suitable since it helped to dry vessels without cracking and even allowed low-temperature thermal treatment of vessels. Then potters' attitude towards plastic raw material gradually changed under the influence of better knowledge of properties of different natural clays and their desire to meet growing consumer demand with their products.

There are four main stages of evolution of main plastic raw material in the history of pottery (Fig. 9):

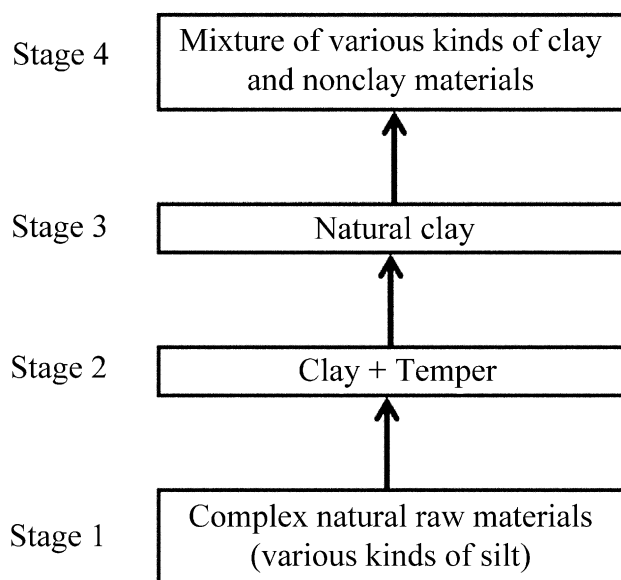


Fig9. The evolution of main plastic raw material

Stage 1: the use of different *silty raw material without tempers* (this is true mostly for the aceramic period and initial stages of *protopottery* production);

Stage 2: the use of artificial plastic raw material of a complex composition: *clay+temper* (mineral or organic). Potters who made vessels of silty raw material when migrating to places without usual silts started using clay raw material adding components which before were readily available in silts. In such a way an artificial version of finished natural raw material was made (it is mostly true for the period of *archaeopottery* production);

Stage 3: production of vessels from *natural clay without tempers*. A lot of experience in work with

different kinds of clay was gained in the process of multiple *mixing of bearers of different traditions in pottery making*. It led to gradual decline in the proportion of tempers in pottery paste (this corresponds to the period of *neopottery simple* production);

Stage 4: is characterized by the widespread use of a special *mixture of different natural clays and nonclay materials*. Such a raw material was widely used for making white clay pottery first highly artistic and later for every day use (porcelain, faience and others).

Summarizing the above information it is possible to determine at the level of *macroevolution* a common pattern for changes of different types of main plastic raw material in the history of

Patterns of Multi Linear Evolution in Pottery Production

pottery: from the use of finished natural raw material with complex composition (silts) to the use of artificial complex raw material (clay+temper), then again to the use of ordinary natural raw material (clay) and finally again to complex artificial raw material (mixture of different clays or clays with nonclay materials). Patterns of the development of potters' views on plastic material at the level of *mesoevolution* will be considered below in the section about evolution of pottery pastes, and patterns of changes in plastic raw material at the level of *macroevolution* if there any remain entirely unexplored so far.

Initial complex artificial pottery pastes (clay+temper) appeared as a result of imitation of complex natural pottery pastes - valley and mountain silts (see above, and also Tsetlin 2013). Here two lines of the development can be identified: from “valley silts” to pottery pastes “clay+organic temper” and from “mountain silts” to pottery pastes “clay+mineral temper”. Further development of pottery pastes is connected with changes, firstly, in qualitative composition of tempers, secondly, in their concentration. In general, we can speak about 4 consecutive stages of development in the history of pottery paste (**Fig. 10**):

The Evolution of Complex Pottery Pastes

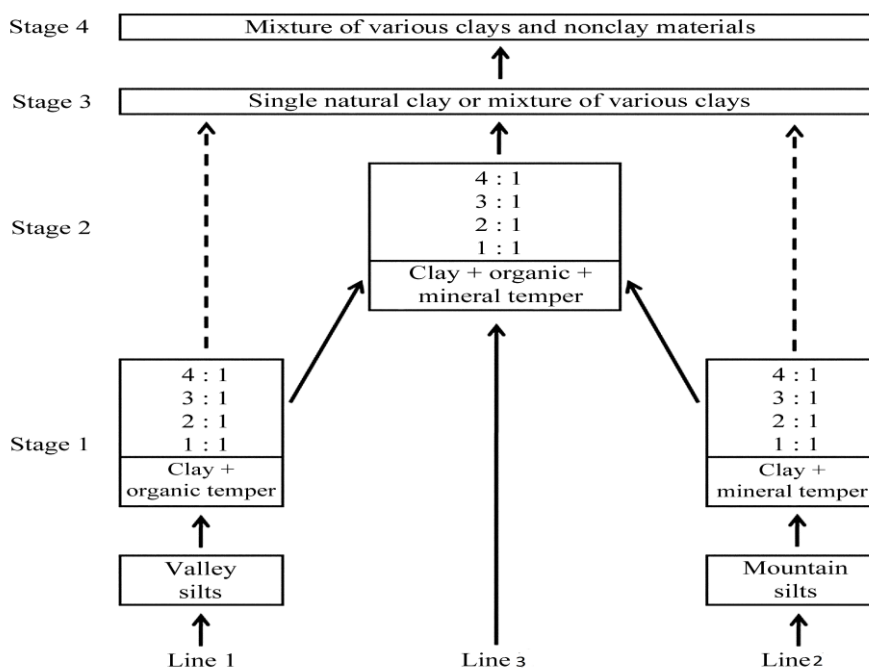


Fig10. The evolution of pottery pastes

Stage 1: Pottery paste consists only of natural silt;

Stage 2a: Pottery paste “Clay + Organic” changes in descending order: share of organic temper is reduced from 2-1:1 to complete absence;

Stage 2b: Pottery paste “Clay + Mineral temper” also changes in descending order: share of mineral temper reduces from 1:1 to complete absence;

Stage 3: Pottery paste “Clay + Organic + Mineral temper” reflects a mixed state as a result of contacts between bearers of tradition of stages 2a and 2b. Here the descending order can be seen too: share of both types of tempers reduces from 1:1 to complete absence.

Stage 4: Its beginning is connected with the completion of descending order in the development of pottery pastes, when vessels are only made of clay (one or several natural clays) without tempers.

The above 4 stages characterize evolutionary changes in the composition of pottery pastes *at the macrolevel*.

The *mesoevolution* of pottery pastes in the history of pottery reflects more individual changes in their composition. The most important here is the process of *self-organization* of the composition of pottery paste (quantitatively) as a result of gradual reduction of share of tempers at stages 2a, 2b and 3 (from their high concentration to complete absence), as already mentioned above.

Patterns of Multi Linear Evolution in Pottery Production

The *microevolution* of pottery pastes was a result of mixing at the qualitative level of different traditions in blending pottery pastes at Stage 2a (use of different types of organic tempers), 2b (use of different types of mineral tempers) and 3 (use of organic and mineral tempers). In this case the evolution has two trends. The first of them is the *divergence* related to the fact that first both traditions lose their stability and then each of them becomes stable again because it is preserved in making vessels with different functions. The second trend is the *self-organization* when *dominant* traditions gradually gain stability again due to assimilation (eradication) of recessive traditions. Evolution of traditions at the microlevel covers a period from one to three years (Bobrinsky 1978, 243).

The Evolution of Vessel Construction Techniques

The starting point for the development of techniques of vessel construction was a “lump” of pottery paste from which either by pressing or beating entire *so monolithic from the bottom to wall seed-body* was made, i.e. the whole vessel of a small size. To make bigger vessels obviously arose the need to complete the seed-body by building up the walls with separate portions of pottery paste (patches, rolls and bands).

In the history of pottery the following stages in the development of techniques of vessel construction are identified (Fig. 11):

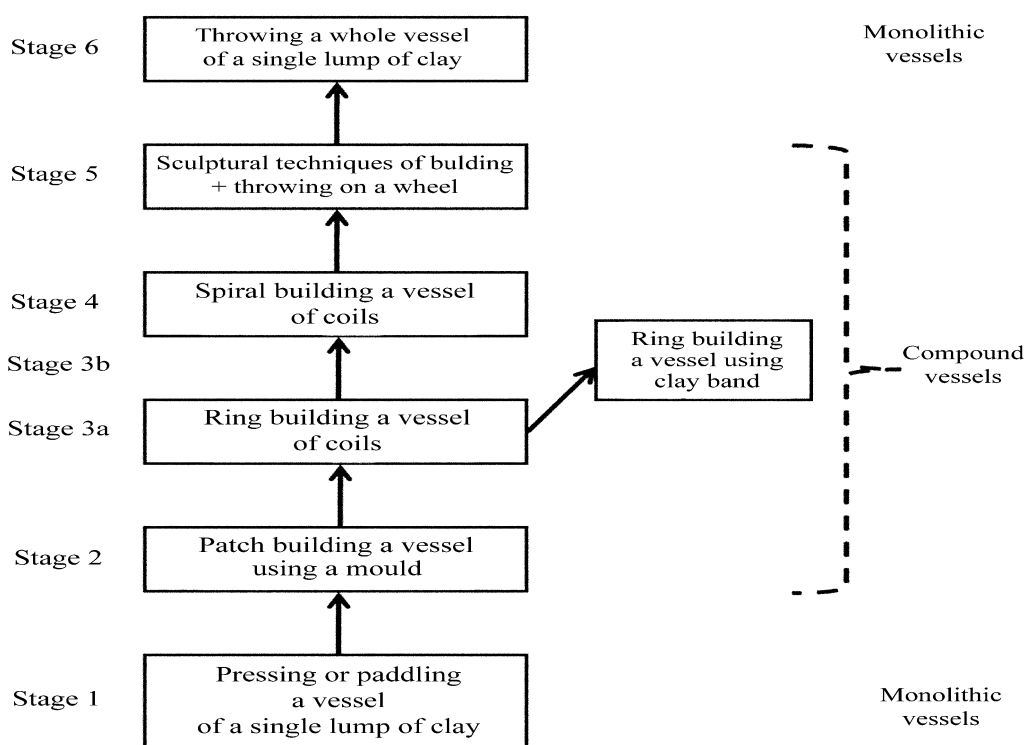


Fig11. The evolution of vessel construction techniques

Stage 1: the vessel construction from a single lump of pottery paste by pressing with fingers or beating with paddle.

Stage 2: the entire vessel construction by patch building using a mould. At this stage there are three phases: 2a – the use of lumpy patch building, 2b – of slope patch building with short coils and 2c – horizontal patch building also with short coils. These phases of the evolution inside the second stage are stimulated most likely by growing production of larger and larger vessels.

Stage 3a: the ring building with coils. Before characterizing the next stage in the development of techniques of vessels construction we should

clarify the status of such a technique as “ring kind of pottery making with clay bands”, since in many cases there is confusion and misunderstanding connected with the definition of its role. First of all it should be noted that this technique cannot be used as the only one for construction of the whole vessel. It is only used as an additional one at 1, 2, 3a (and even 4) stages of the evolution mostly for increasing the capacity of a vessel. Even when the ring kind of building with bands is used for making seed-body as a hollow cylinder or cone it requires an additional technique or element for making the vessel’s bottom.

Patterns of Multi Linear Evolution in Pottery Production

Stage 4: the spiral building with coils. The very principle of spiral building is most clearly seen while constructing from the bottom to wall seed-body when such a building happens in a natural way. Then this principle is preserved even when the length of coil is not enough to turn it around the perimeter of the vessel's walls. Here next coil is stuck to the end of the first one which covers next spiral turn etc.

Stage 5: the transition to this stage happens in pottery at the moment when potter's wheel was used for throwing clay for the first time. Here sculptural moulding of a vessel (using methods typical for stages 1-4) is combined with eventual partial throwing of such a semi-finished item on potter's wheel. The share of throwing gradually grows throughout the stage.

Stage 6 entails making the whole vessel by throwing it on potter's wheel from a single lump of clay.

In such a way at the level of *macroevolution* we witness a logical transition from making a monolithic vessel from a single lump of pottery paste to a composite vessel made of several structural elements (patches, coils, bands), and from this one to another composite vessel but already partly thrown on potter's wheel and further to a vessel completely thrown on potter's wheel from a single lump of clay.

In such a way common patterns of evolution in technology of vessel construction consist in the transition from a monolithic vessel's body to a

composite body and again to a monolithic vessel's body but already at a more advanced level of development.

The *mesoevolution* in technology of vessels construction is connected with a lasting mixing of traditions which covers stages of shaping, making hollow body and seed-body of a vessel. According to A.A. Bobrinsky (1978, 243-244) the 4th, 5th and 6th stages of the mixing correspond to it which takes from one to 5-6 generations of potters. As a result of mixing bearers of different traditions in vessel construction first we can see homogeneous traditions in methods of shaping a vessel, then of hollow body construction and finally of a seed-body. However such a long process of mixing between two groups of bearers of different traditions doesn't happen often in practice.

The *microevolution* of technology of vessel construction is also connected with mixing of bearers of different traditions. Variations of such manifestations are abundant. For example, combined use of spiral patch building and ring building technique from clay bands led to spiral-zone patch pottery making in which bands were not monolithic but composed of different patches of clay (Bobrinsky 1978, 159-160), and mixed bearers of traditions of ring building technique with bands and spiral building technique with coils (depending on who was the bearer of the dominant tradition) could lead either to the formation of spiral building technique with bands (Tsetlin 2017, 225) or to the ring building technique with coils.

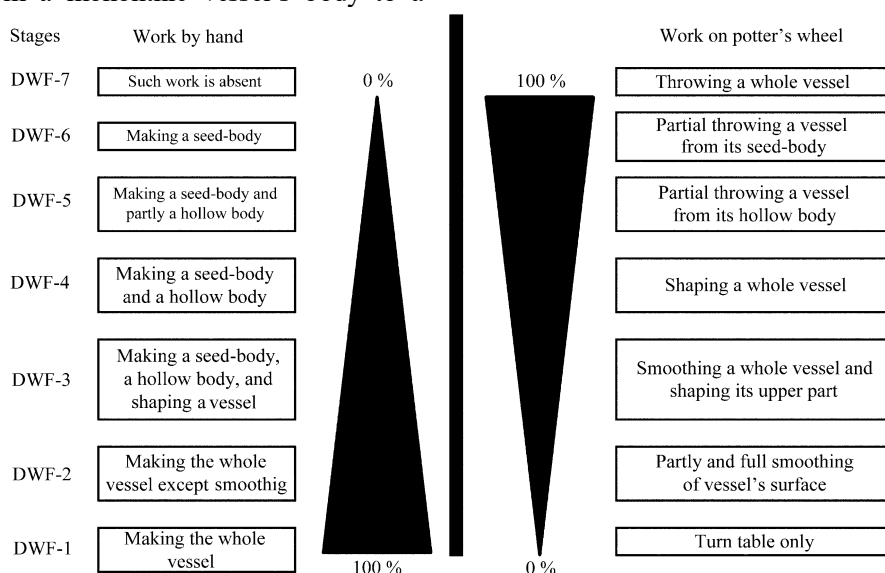


Fig12. The evolution of potter's wheel functions

The Evolution of Potter's Wheel Functions

First potter's wheels appeared as a result of transition from *uncentral* to *central* plates

(Bobrinsky 1993b). Main function of the potter's wheel is shaping a vessel with the help of centered rotation of clay in the same plane. From this point the *development* of potter's wheel

Patterns of Multi Linear Evolution in Pottery Production

functions depends on how fully the possibilities of such a rotation are used in the process of making a vessel (Fig. 12).

A.A. Bobrinsky divided the whole process of evolution of potter's wheel functions into 7 consecutive stages (1978, 26-66):

DWF (development of wheel functions)-1: the vessel is fully hand-made and the wheel is used only as a turn-table;

DWF-2: the vessel is fully hand-made and the wheel is used only for smoothing its surface;

DWF-3: the vessel is fully hand-made and the wheel is used only for smoothing its surface and profiling its upper part;

DWF-4: the vessel is fully hand-made and the wheel is used only for giving it certain form;

DWF-5: the seed-body and hollow body of the vessel are hand-made and the wheel is used for partial throwing of the hollow body;

DWF-6: the seed-body of the vessel is hand-made and all other manipulations connected with its manufacturing are carried out thanks to spinning potter's wheel;

DWF-7: the vessel is fully made on potter's wheel by throwing from a single lump of clay.

In such a way the *common pattern* in the evolution of potter's wheel functions consists in gradual expanding scope of wheeled pottery making and reduction of hand type of it. The mechanism of

evolution of potter's wheel functions consists in *gradual increased duration of the wheel's rotation* in the process of vessel making thanks to *reduced friction in supporting and sliding bearings of the wheel*.

For the stage DWF-1 this factor doesn't play any role, the wheel each time doesn't even come full circle, it just rotates through certain angle, i.e. the vessel turns to the potter with the side which is to be treated at the moment.

At the stage DWF-2, firstly, the direction of smoothing of the vessel's surface gradually changes from vertical to diagonal and further to horizontal, secondly, the surface of the vessel subject to smoothing gradually becomes larger. At that the vessel at least several times rotates around its axis and in doing so the impact of the potter on clay is minimal.

Stages DWF-3 and DWF-4 require much stronger impact on clay necessary for profiling the vessel and giving it its final contour. Since intensified impact on clay hinders the duration of rotation it becomes necessary to increase the weight of the wheel and to reduce friction in its bearings.

This trend continues to be active at stages DWF-5-7 when *intensity* and *scope* of the potter's impact on clay to make a vessel increases considerably: from hollow body to seed-body and finally to the whole vessel. Further increase of wheel's weight and reduced friction in its bearings provide the duration of rotation which is necessary for throwing a vessel from a single lump of clay.

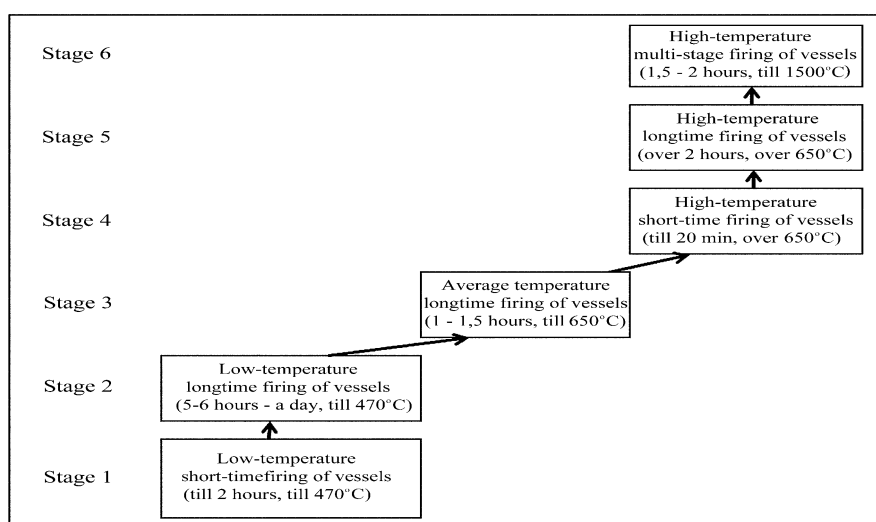


Fig13. The evolution of pottery firing techniques

In such a way the evolution of potter's wheel functions is achieved by *steadiness* and *duration* of its rotation in one plane. In various places this can be seen on the one hand in expansion of foot-wheels with a massive lower disc and hand-wheels

of heavy types and on the other hand in the use of special lubricant for wooden parts of bearings, in substitution of wooden bearings by metal ones and finally in transition to electric pottery wheels. The development of potter's wheel functions

Patterns of Multi Linear Evolution in Pottery Production

corresponds to the *macrolevel* of the evolution of this phenomenon in the history of pottery.

The Evolution of Pottery Firing Techniques

The objective of heat treatment (firing) of a vessel has always been to make it hard and waterproof. There are 6 main stages in the development of heat treatment of clay vessels in the history of pottery (Fig. 13):

Stage 1 is connected with a short exposure of a vessel (not more than an hour) to very low temperatures not more than 450-470°C. In fact such a treatment can not be called firing but a thermal drying of vessels. Vessels retain their residual plasticity almost in full after such drying. This stage has been hypothetically reconstructed based on a number of vessels with considerable residual plasticity combined with a thin light in color (fully fired) layer from the side of outer surface which as a rule appears in the vessel in the process of cooking on fire.

Stage 2 is characterized by heat impact at the same maximum temperatures but unlike stage 1 this treatment was much longer (from several to 24 hours). Vessels completely lose residual plasticity and are suitable for cooking liquid food on fire.

Stage 3 (transitional) implies heating the vessel to a temperature of 560-650°C during 1-1,5 hour. The firing atmosphere is semi-reducing. Vessels completely lose residual plasticity. The middle part of the core is dark as a rule, both surfaces are lighter in color.

Stage 4 is connected with a quick rise in temperature over 650°C, soaking at the maximum temperature 10-20 minutes and eventual rapid or slow cooling of vessels. It is characterized by zero

residual plasticity, incomplete firing of pottery with a distinct or blurred colour boundary between surface layers and the middle part of the core.

Stage 5 is characterized by a slow rise of temperature over 650°C, long soaking and slow cooling of vessels. Pottery is fully fired.

Stage 6 reflects two or multi-stage firing of vessels made of white clay (porcelain, faience) or vessels with glazing at a temperature up to 1400-1500°C.

First two stages of heat treatment characterize *unformed* condition, stage 3 - *partly-formed* and stages 4-6 *fully-formed* notions of ancient potters about pottery firing as a special technological procedure. The stages described above reflect the *macrolevel* of the evolution in methods of firing clay vessels.

In such a way the development of ancient potters' notions about the heat treatment of vessels is reflected in gradual mastering and increasing use of red-hot temperatures of clay on the one hand and length of thermal impact on vessels fired on the other hand.

The Evolution of Pottery Firing Devices

There are 4 classes of such special thermo technical devices in the history of pottery: *bonfires, ovens, stoves and kilns*. The process of evolution of each of these devices can be divided into several stages (Fig. 13). In this article I summarize information on stages of the development of these thermo technical devices. (More detailed information can be found in the following works: Bobrinsky 1991b, 93-134; Bobrinsky, Volkova, and Gey 1993; Tsetlin 2002b).

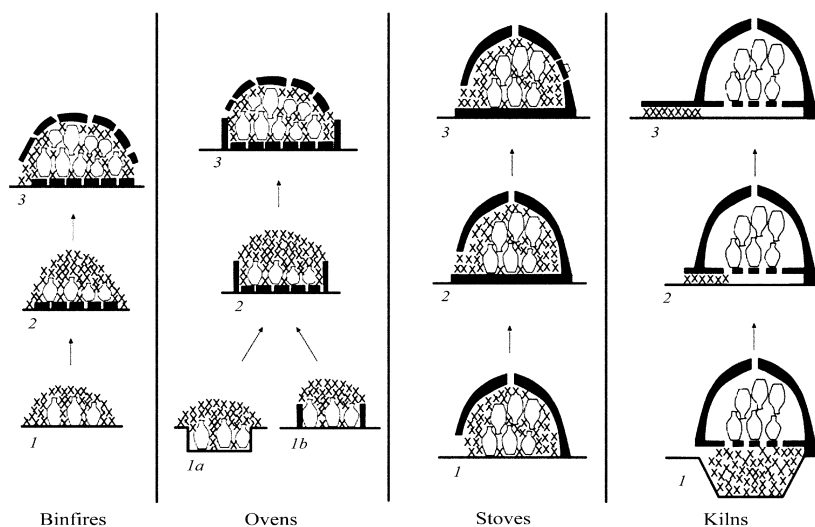


Fig14. The evolution of pottery firing devices

Bonfires

Patterns of Multi Linear Evolution in Pottery Production

Stage 1: the bonfire is built in a smooth horizontal area directly on the ground. Vessels are piled mixed with fuel and are covered with it from all sides.

Stage 2: a platform of small wooden planks, stones and clay is previously made. The vessels fit for firing are stacked on the platform together with fuel. Then the whole pile is covered with additional fuel.

Stage 3: mostly repeats stage 2, but after placing additional layer of fuel the whole pile is covered with big fragments of old vessels forming a dome with openings.

Oven devices

Stage 1a: is characterized by an oven dug into the ground with up to 1/3 of its diameter. The bottom of the oven is covered with a layer of ash, vessels fit for firing are piled over it which are later covered with a thin layer of ash. Then fuel is placed on top and the sides of the pile.

Stage 1b: the oven is made above the ground. The firing area is limited by a wall of clay and stones over the perimeter. Vessels together with fuel are piled inside and covered with it from above.

Stage 2: the oven is made which is either dug into the ground or above the ground but it has a platform on which vessels are piled together with fuel and covered with fuel from above.

Stage 3: repeats the construction from the previous stage but in this case all layer of fuel is covered from above by large sherds which form a dome.

Stove devices

The three inevitable differences appear in the design of pottery stoves (in comparison with ovens): firstly, a permanent covering over vessels and fuel (a dome with a special opening for increasing draft), secondly, a special fuel loading device which also helps to keep it burning, thirdly, a loading device for placing vessels fit for firing. This process can also be divided into three stages in terms of time:

Stage 1: the stove has a permanent dome and a combined loading device for both fuel and vessels.

Stage 2: at this stage a special platform for placing fuel and vessels fit for firing is added to the permanent dome and the combined loading device.

Stage 3: all old structural elements are preserved, but loading devices for fuel and vessels fit for firing are separated, usually they are made from different sides of the stove.

Updraft pottery kilns

Stage 1: a deep chamber for fuel combustion is situated directly under the firing chamber where vessels are piled. The chambers are separated by a horizontal partition with openings for transition of hot gases. On the plan both chambers could be either circular (older tradition) or rectangular (later tradition).

Stage 2: the fuel combustion chamber is at the ground level, a small fuel channel leads to it which is partly used for the same purpose. The firing chamber is situated above the fuel chamber.

Stage 3: the construction of this stage repeats the previous one with the only difference. The fuel channel which leads to fuel combustion chamber is much longer and is used for fuel burning.

The stages of the development of firing devices in pottery described above characterize changes happening at the *microlevel* of the evolution which cover all the history of this production. Nevertheless these evolutionary lines didn't exist in isolation but had strong reciprocal influence. It could be seen in cultural contacts of bearers of different traditions in making firing devices (mesolevel of the evolution). The fact of transition from temporary domes over bonfires and ovens to permanent domes which become necessary structural element of stoves and kilns can serve as an example. Evolutionary changes of firing devices at the microlevel (if only they existed) haven't been proved by any concrete data so far.

What are *main trends of evolution* in firing devices? Firstly, the main evolutionary trend was undoubtedly ancient potters' desire to facilitate the control over the firing process. It is available to a very limited extent in bonfire type of firing and to the fullest extent in kiln firing. Secondly, one more indisputable trend was their desire to reduce the waste of thermal energy produced by fuel combustion. For this reason the devices had special platforms for placing vessels and fuel and covers first temporary and then permanent were made over them. Thirdly, to make the firing more uniform and improve the appearance of the produce the kilns were divided into two chambers. One of them served for fuel combustion and another for stacking vessels to be fired. As a result the firing of vessels happened thanks to direct thermal energy impact without direct contact with fuel.

CONCLUSION

Summarizing the short analysis of some aspects of ancient pottery evolution in this article a number of important moments should be noted.

Firstly, the decisive line in the evolution of this sphere of human culture is the progressive development connected with an increasing efficiency of all components of technical-technological process.

Secondly, the evolution of different sides of pottery production happens at three levels which vary in scale. At the *macrolevel* evolutionary changes cover all period of the development in this sphere of human culture and are caused by increasing efficiency of the production (as stated above) on the one hand, and fuller satisfaction of pottery users' growing demands on the other hand. At the *mesolevel* contacts between bearers of different pottery traditions serve as the main evolutionary mechanism. They are first accompanied by instability in pottery production and then by recovery of production as a result of self-organization of production under the influence of the dominant bearers' traditions. Evolutionary changes at the *microlevel* are also manifested either as a result of contacts of bearers of different traditions or are connected with age-related physiological changes in potters' labour process. In terms of time the changes at this level cover a period from several years to a generation of potters.

Thirdly, the evolution of pottery as a certain functioning system is determined by internal patterns of its development on the one hand and on the other hand by those changes which happen in other spheres of human culture and society as a whole to which pottery production is very closely related.

ACKNOWLEDGEMENTS

At first I am very grateful to Prof. Alexander A. Bobrinsky, a former Head of the History of Ceramics Laboratory and my teacher for more than forty years. Besides,

I would like also to thank all my colleagues at the History of Ceramics Laboratory in the Institute of Archaeology of the Russian Academy of Sciences in Moscow, and all Russian scholars working in the field of ancient ceramics.

REFERENCES

- [1] Bobrinsky, A.A., (1978) *The Pottery of Eastern Europe. Sources and Methods of Study*. Moscow. 272 p. (In Rus.)
- [2] Bobrinsky, A.A., (1991a) The Envelopes of Clay Vessels' Functional Parts. *Archaeological Studies in the Forest-Steppe Zone of the Volga River Basin* (edited by G.I. Matveeva), 3-35. Samara. (In Rus.)
- [3] Bobrinsky, A.A., (1991b) *Pottery Workshops and Kilns in Eastern Europe (Based on Materials from the 2nd -5th Centuries AD)*. Moscow. 215 p. (In Rus.)
- [4] Bobrinsky, A.A., (1993a) The Origin of Pottery Production. *Ukraine's Pottery Production. Research Series* (edited by O. Poshivailo). Vol. 1, 39-55. Kiev-Opishne. (In Rus.)
- [5] Bobrinsky A.A., (1993b) *The Pottery Wheel and its Origin*. Ekaterinburg. 56 p. (In Rus.)
- [6] Bobrinsky, A.A., (1997) On Structure and Origin of Pottery Technology. *Antiquities. Concepts. Discoveries. Versions*. (edited by S.V. Beletsky). Vol.1, 90-96. Saint-Petersburg; Pskov. (In Rus.)
- [7] Bobrinsky, A.A., (1999) Pottery Technology as a Subject of Historical and Cultural Study. *Actual Problems of Ancient Pottery Investigations* (edited by A.A. Bobrinsky), 5-109. Samara. (In Rus.)
- [8] Bobrinsky, A.A., (2006) Technological Data on the Origin of Pottery. *Problems of Archaeology of the Volga Basin* (edited by I.N.Vasilieva). Vol. 4, 413-421. Samara. (In Rus.)
- [9] Bobrinsky, A.A., (2018a) Covers of Clay Vessels' Functional Parts. *Shapes of Clay Vessels as a Subject of Study. Historical-and-Cultural Approach* (edited by Yu.B.Tsetlin), 41-59. Moscow. (In Rus.)
- [10] Bobrinsky, A.A., (2018b) Mechanisms of New Vessels' Shapes Incorporation. *Shapes of Clay Vessels as a Subject of Study. Historical-and-Cultural Approach* (edited by Yu.B.Tsetlin), 60-62. Moscow. (In Rus.)
- [11] Bobrinsky, A.A., and Vasilieva, I.N. (1998) On Some Peculiarities of Plastic Raw Material in the History of Pottery Production. *Problems of North Caspian Basin Ancient History* (edited by I.B. Vasiliev), 193-217. Samara. (In Rus.)
- [12] Bobrinsky, A.A., Volkova, E.V. and Gey, I.A. (1993) Bonfires for the Firing of Ceramics. *Archaeological Investigations in Povolgie* (edited by G.I. Matveeva), 3-44. Samara. (In Rus.)
- [13] Holmes W.H., (1883a) Ancient Pottery of the Mississippi Valley. *Smithsonian Institution. Bureau of Ethnology*. 361-436. Wash.
- [14] Holmes W.H., (1883b) Origin and Development of Form and Ornament in Ceramic Art. *Smithsonian Institution. Bureau of Ethnology*. 437-465. Wash.
- [15] Tsetlin, Yu.B., (1991) *Periodization of the Neolithic in the Upper Volga River Basin. Methodological Problems*. Moscow. 195 p. (In Rus.)
- [16] Tsetlin, Yu.B., (2002a) The Origin of Graphic Pottery Decoration (The Rise of the Problem). *Tver Archaeological Symposium* (edited by I.N. Chernykh). Vol. 5, 231-240. Tver. (In Rus.)
- [17] Tsetlin, Yu.B., (2002b) Pottery kiln at Tell Hazna I and its position in kiln evolution. The ceramics

Patterns of Multi Linear Evolution in Pottery Production

- from the kiln. *Modern Trends in Scientific Studies on Ancient Ceramics*. Papers presented at the 5th European Meeting on Ancient Ceramics, Athens 1999 (eds. by V.Killikoglou, A Hein, Y.Maniatis). 85-94. BAR International Series 1011.
- [18] Tsetlin, Yu.B., (2005) Ceramics Culture: a Real System and a Source of Historical Information. *Understanding people through their pottery*. Proceedings of the 7th European Meeting on Ancient Ceramics (EMAC'03). October 27-31, 2003, 271-278. Lisbon.
- [19] Tsetlin, Yu.B., (2006) The Origin of Graphic Modes of Pottery decoration. *Prehistoric Pottery: Some Recent Research* (ed. by A. Gibson). Prehistoric Ceramics Research Group. 1-10. BAR International Series 1509.
- [20] Tsetlin, Yu.B., (2010) Ceramic Investigations in Russia. Scientific approaches, pottery production structure, modern possibilities and some research results. *Journal of Nordic Archaeological Science*. 17, 65-81.
- [21] Tsetlin, Yu.B., (2012) *Ancient Ceramics. Theory and Methods of Historical-and-Cultural Approach*. Moscow. 384 p. (In Rus.)
- [22] Tsetlin, Yu.B., (2013) Modern Views on the Origin of Pottery Making. *Tomsk State University Journal. History*. 3 (23), 74-80. (In Rus.)
- [23] Tsetlin, Yu.B., (2017) *Ceramics. Concepts and Terms of Historical-and-Cultural Approach*. Moscow. 346 p. (In Rus.)
- [24] Tsetlin, Yu.B., (2018a) The Origin of Ancient Pottery Production. *Journal of Historical Archaeology and Anthropological Sciences*. 3(2), 193-198.
- [25] Tsetlin, Yu.B., (2018b) On General Approach and Methods of Vessels' Shapes Systematic Study. *Shapes of Clay Vessels As a Subject of Study. Historical-and-Cultural Approach*. Moscow, 124-179. (In Rus.) <http://doi.org/10.2568/IARAS.2018.978-5-94375-254-4.124-179>
- [26] Vasilieva, I.N., (2009) On the Evolution of Notions about Plastic Raw Material of the Neolithic Population in the Steppe Zone of the Volga River Basin (Based on Material of the Varfolomeevo Site. *Problems of Studying the Early Bronze Age Cultures of the Steppe Zone of Eastern Europe* (edited by N.L.Morgunova), 65-70. Orenburg. (In Rus.)
- [27] Volkova, H.V., (2017) The Cultural Background of the Population and Relative Periodization of Habitations in the Galankina Gora Settlement (Based on the Study of Ceramics). *Institute of Archaeology Short Reports (KSIA)*, 249, I, 153-166. (In Rus.) <http://doi.org/10.2568/1/IARA.S.0130-2620.249-1.153-166>

Citation: Yu.B. Tsetlin, "Patterns of Multi Linear Evolution in Pottery Production", *Annals of Archaeology*, 3(2), 2020, pp. 1-14.

Copyright: © 2020 Yu.B. Tsetlin. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.