EXPERIMENTAL RESEARCH INTO POTTERY MAKING

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Issue definition

A common aspect of the study of ancient pottery technology is the investigation of the different properties of natural clays (especially the chemical composition and the proportion of natural non-plastic micro-inclusions) and the identification of deliberately added or natural occurring inclusions. This can be achieved using chemical, mineralogical and elemental analyses. These techniques were primarily developed in the natural sciences, and thus the transfer of these methods and results to the study and interpretation of ancient ceramics technology and material must be considered carefully.

At the same time, experimental research into actual ancient manufacturing techniques attracts very little attention, because this part of pottery technology is almost inaccessible to natural sciences. During the last few decades, applications of methods such as nuclear magnetic resonance NMR-spectrography and computer tomography have not demonstrated clear development and that is why they are not yet regarded as significant in archaeology, for many reasons (including their high cost). In general, the application of techniques originally used for natural sciences to the study of ancient pottery-making technology require a thorough, regular and all-round research.

The same situation is typical of Russian archaeological science as well. But the scholars – followers of "*Historical-and-Cultural*" (Tsetlin 1999, 6) approach – emphasise purposeful research of pottery cultural traditions through all the steps of pottery technology, including the different phases of pottery manufacturing. Alexander A. Bobrinsky (1978) elaborated a special system of experimental construction methods for the study of pottery-manufacturing through evidence in the cores of broken sherds and on the surfaces of vessels using a simple binocular microscope. Nevertheless, this task remains relatively difficult. The reliability of the reconstruction of pottery manufacturing processes depends entirely on the mastering of investigative techniques, on the scholar's training and personal experience.

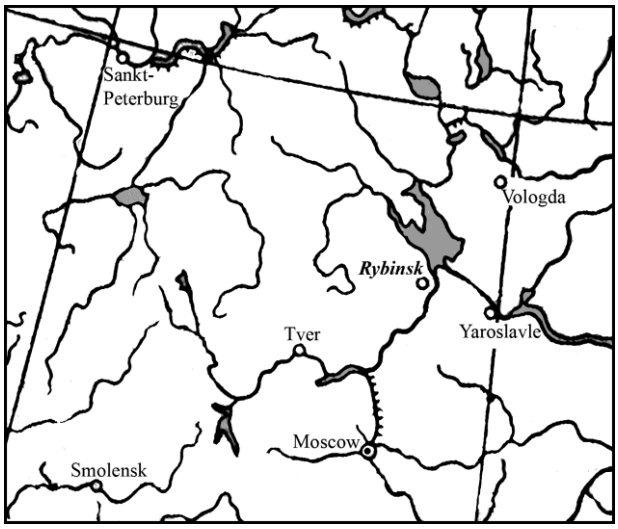

Fig. 1. Map of European Russia with the place of Rybinsk-city.

Goal and tasks of research

This work was carried out at the special experimental centre for the study of ancient pottery production which has been run by the author since 2004 within the Rybinsk archaeological expedition, directed by Alexander and Irina Rukunov, in the Yaroslavskaya district of the Russian Federation (Fig. 1).

A wide experimental programme was developed to create the standard small vessels with the "traces" which remain in their cores as the result of various pottery-making techniques. The aims were to define a) where the joint lines between various pieces of clay were placed, and b) which form these lines take in the cores of vessels. In addition, I wanted to determine whether any change in these traces was caused by the potter's efforts to alter the clay.

In brief, the research programme includes:
1) making small clay vessels out of various structural elements such as a) patches, b) coils, and c) bands;
2) beginning manufacturing vessels according to four methods: a) "Base-only" construction, b) "Base-and-Wall" construction, c) "Wall-and-Base" construction, and d) only "Wall" methods of building vessels

construction. During the manufacture of the experimental vessels, the various structural elements were connected with each other by a) simple smoothing, b) smoothing and additional pressing by finger-pressure, and c) smoothing and additional beating with flat paddle. As a result of these processes, the base and wall of the vessels were subjected to a) weak, b) average, and c) strong deformation respectively. The *weak* deformation is a result of simple smoothing of structural elements, the *average* one is characterized by the 1/3 thinning of the original walls during pressing or beating, and the *strong* deformation appeared after making the walls thinner by 2/3 of the original thickness.

To have a clearer picture, the structural elements (patches, coils, and bands) were made alternately of white and black clays. The experimental vessels were only dried and were not fired, as the black and white clays shrink at different rates when fired, and the vessels would not have remained intact. Dried vessels were then sliced vertically (through the central axis) and horizontally (1 cm below the edge of the rim) using a cutting machine with a diamond-coated disk .

As a result, we see two perpendicular projections of joints between structural elements in the base and wall of vessels (Fig. 2).

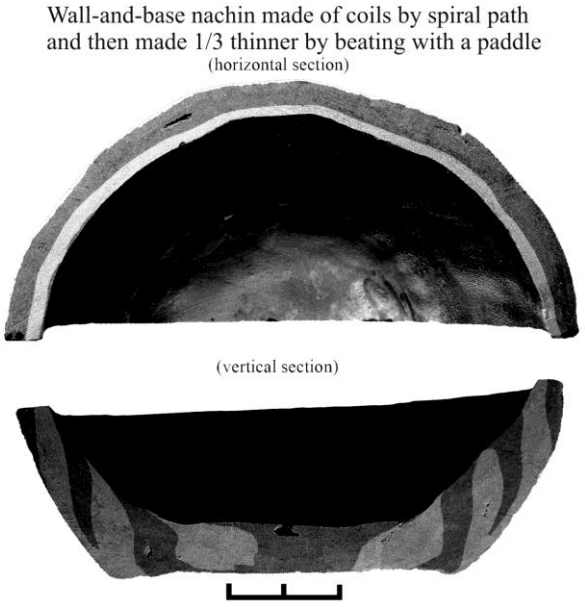

Fig. 2. Two perpendicular projections of an experimental vessel.

Description of the summer 2008 experiments

During the summer of 2008, we could not realize the full programme of experimental work, due to wet weather. Only six types and 22 variants of construction modes were tested. We tried to study the patch mode which is the most ancient, and consequently very difficult to identify by visual observation of archaeological ceramics. The experimental vessels were made on a convex hemispherical solid mould, covered with fabric to prevent clay from sticking to the mould (Fig. 3).

Fig. 3. A convex hemispherical solid mould covered with fabric and used for construction of experimental vessels.

Small vessels were made according to two methods: Base-and-Wall and Wall-and-Base. In the first case, pieces of clay were added from base to wall, and in the second one, from wall to base. They were made of unformed clay patches (when pieces of clay are torn off from a large clay pyramid), of short cylindrical patches (2 cm in diameter and 4 cm long), and of flat clay pellets (4 cm in diameter and 1 cm thick). During the process of pottery-making, clay patches were joined to each other by smoothing with minimum deformation by fingers, or smoothing and pressing with fingers or beating with a paddle with deformation of 1/3 or 2/3 of the original thickness.

Experimental results

A few examples are described here to illustrate the results of this work. The simplest mode consists of making clay vessels of unformed patches according to Base-and-Wall and Wall-and-Base methods on the convex mould.

Base-and-Wall (B&W) *method* (vessels are made of clay patches placed in a circle starting at the centre and working towards the edge of the convex mould):

Variant 1. The patches are joined and smoothed with minimum deformation. The picture of joints in horizontal and vertical projections is showed on *Fig. 4a*.

Wall-and-Base (W&B) *program* (vessels are made of clay patches placed in a circle from the edge to the centre of the convex mould):

Variant 1. The patches are joined and smoothed with minimum deformation (*Fig. 4b*).

Variant 2. The patches are joined by smoothing and finger-pressure, reducing the original wall thickness by 1/3 (*Fig. 4c*).

Variant 3. The patches are joined by smoothing and finger-pressure, but reducing the original wall thickness by 2/3 (*Fig. 4d*).

Variant 4. The patches are joined by smoothing and beating with a paddle, reducing the original wall thickness by 1/3 (*Fig. 4e*).

Variant 5. The patches are joined by smoothing and beating with a paddle, reducing the original wall thickness by 2/3 (*Fig. 4f*).

The numbers on all figures show the order of addition of clay patches during the construction of experimental vessels.

Let us consider the horizontal and vertical sections of vessels made according to Base-and-Wall and Wall-and-Base methods (*Fig. 4a, b*). In both cases, the vessels were only smoothed, without any additional treatment. The direction of joint lines between patches, as seen from inside the vessel, is from right to left under the Base-and-Wall method (*Fig. 4a*) and from left to right under the Wall-and-Base method (*Fig. 4b*) . This contrast does not depend on the mode of construction, but is the result of clockwise addition of patches (in the first case) and of anti-clockwise addition of patches (in the second one). Such differences can reflect cultural traditions of pottery making, or whether the potter is right-handed or left-handed.

More important results are obtained by the analysis of vertical sections of experimental vessels made according these two *methods*. Under the Base-and-Wall method (*Fig. 4a*), the first patch was placed near the central part of the Base, and following patches were placed more distant from the centre, partly covering the previous ones. Under the Wall-and-Base method (*Fig. 4b*), the first patches were placed on the rim and the patches closer to the Base partly cover them. Consequently, the determination of the direction of joint lines in vertical sections of vessels permits the definition of these two kinds of nachin methods in archaeological ceramics.

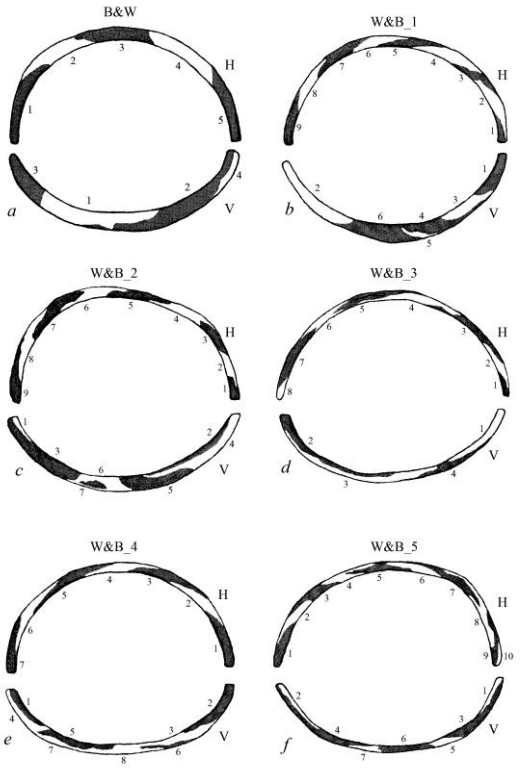

Fig. 4. Horizontal and vertical sections of experimental clay vessels.

Using the example of Wall-and-Base experimental vessels, I would like to consider the peculiarities of the outline of the patches in vertical section in the cases of various degrees of additional deformation of walls by pressing with fingers and by beating with a flat paddle (*Fig. 4, c-f*). Firstly we can see here the elongation of patches and joint lines, but this effect becomes clear only when the vertical section passes through the central part of a patch, not through the edge of one.

Therefore to determine the degree of additional deformation I propose a quantitative method including the determination of 1) the average area of a few large patches seen in vertical section, 2) the nominal diameter of a circular patch with this area, 3) the average thickness of a few large patches in the same section. Now to test the degree of deformation we need to calculate the ratio between the average thickness of a patch and the nominal diameter of an ideal round patch before any kind of deformation.

Generalization of experimental data suggests a scale for the estimation of the degree of clay deformation under patched modes of construction (the question of applicability of this scale for estimation of the other modes of construction remains open). It has

been established that when the patches are joined and smoothed (without additional deformation), the ratio of T (thickness) to D (nominal diameter) is about 45-50%, with deformation of 1/3 of initial wall thickness – about 35-40%, and with deformation of 2/3 of initial wall thickness – about 25-30%.

The experimental data received during the investigation of vessels made of short cylindrical patches and round clay pellets confirm these results. During the next summer the experimental works will be continued.

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References

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