DESCRIPTION

OF

TWO PROCESSES FOR TAKING MOULDS

FROM

SCULPTURES IN BAS-RELIEF,

IN INDIA,

BY

DR. FORBES FOX TSON.

1869

INDIA MUSEUM.
Description, by Dr. Forbes Watson, of Two Processes for taking Moulds from Sculptures in Bas-relief, &c., in India.*


The following articles are required:—
Several brushes, scissors, knives, &c., as per figures in the accompanying illustration.
A saucepan for making paste, with a large and a medium sized sponge.
Wheat flour; alum; glue; resin† finely pounded; linseed oil; cut fibre;† waste paper; steatite or soapstone,§ finely ground or pounded; India-rubber; asphaltum; coal tar; naphtha; and, lastly, paper for moulding, as per samples appended.

The whole of the materials above named are easily procurable in India, all of them, with the exception of the naphtha, being products of the country.

Some of the native-made papers are admirably adapted for moulding. The sample No. 1 from Patna, which is recommended (see sheet of specimens appended), has been selected from a number of specimens in the India Museum Collection, and is superior to the paper commonly employed in this country for moulding purposes.

Preliminary operations.—Before commencing to mould from exposed sculptures, it will be necessary to screen them from the rays of the sun and from gusts of wind. This, in the case of a large erection, like one of the gateways to the Sanchi Tope, will require the collection on the spot of a considerable amount of scaffolding, which will have to be set up, for the double purpose of allowing the work to be got at, and of forming the support for whatever may be used as a screen. For this latter, tent canvas, made up in some convenient form, would probably answer best; but, whatever may be the material employed, it should be so arranged as to be readily removable, in order to allow the sun to act upon the mould in proportion as it is completed, so as to ensure its being rapidly, as well as thoroughly, dried before its removal from the sculpture.

Commencing at the top, the work to be operated on has to be washed, or otherwise completely cleansed from dust and all foreign matters.

Before commencing the actual operation of moulding, the following materials have to be got ready.

1. Paste.—A good formula is as follows:—
Thoroughly mix 4 lbs. of flour, 2 oz. of alum, and ½ lb. of finely pounded resin in four quarts of cold water. Boil ½ lb. of glue in four quarts of water, in a large saucepan, and while boiling add the mixture of flour, &c., as above, and keep it well stirred till the whole begins to boil. When cold it is ready for use.

* The processes here described have been practically carried out by Mr. W. Griggs in connexion with the preparation at the India Museum of the relief-maps of India, now in course of construction for the Government of India and for that of Madras and Bombay.
† The Gunda-beroza of the bazaar, from the *Pinus longifolius* and other conifers.
† Jute or other soft fibre, cut into from ½ to ¾ inch lengths.
§ This, under the native and trade name of Sunkiserro, is common in India, and is superior to the whitening (washed chalk or carbonate of lime) generally used in this country for the same purpose.
2. **Composition, Carton-pierre.**—This substance, which is a kind of *carton-pierre,* is required, as the work proceeds, to fill up or back hollows of moderate depth in the paper mould, as also to carry out the process next to be described. It is prepared as follows; the quantities indicated being such as would be required only in cases in which a considerable surface of work was expected to be completed by the paper process within a short time of its commencement. But in the process, to be afterwards described, where the composition itself is used for making almost the entire mould, the quantities here given will be found to be only sufficient for one working, should the sculpture to be operated upon be of any considerable extent.

To 9 lbs. of pounded resin add one quart of linseed oil. Boil in kettle and retain till required.

Take of flour 6 lbs., mix with 10 quarts of cold water, add 1 lb. of alum, and boil the whole until a proper consistency has been obtained. Then add to the above paste,—which should be kept boiling in a copper or other large vessel,—paper pulp, which has been previously prepared by soaking from 10 to 12 lbs. of waste paper in water for several hours.

The pulp, from which the water has been squeezed out, should then be added in successive quantities to the boiling paste, along with the resin and oil mixture, and the whole should be kept boiling until it has assumed a proper consistency.

To the mass thus formed, and still kept boiling, add, in successive quantities, 1 lb. of jute or other soft fibre, cut into quite short pieces, taking care to mix the whole thoroughly.*

Next add about 12 lbs. of finely pounded steatite, boiling the whole for about ten minutes, and taking care to keep the mixture constantly stirred, a precaution which has to be taken throughout.

When cold, roll up with enough of the steatite to make it workable like ordinary putty. If not required for immediate use, the batch must be kept rolled up in a macintosh or oil-skin cloth to prevent its drying.

When quick setting is desired, equal parts of steatite and plaster of Paris should be used for rolling up with the mass just before it is required to lay on the work.

3. **Moulding Papers.**—These should also be got ready, in order that the operation of moulding may be proceeded with.

The first layer of paper, or that which forms the surface of the mould, and comes into immediate contact with the casts, is the one which chiefly requires care, as well to secure the continuity of the surface, as to ensure complete contact with every portion of the work.

To this end, a convenient number of sheets similar to the No. 1 paper are well pasted on one side only, and then either doubled or placed one on the other with the pasted surfaces together, and rolled up in a damp cloth, with an outside cover of macintosh or oil-skin, to prevent evaporation. They should thus be kept for several hours before being used. The sheets as used in this country are not previously soaked in water, as it is found that the paste, when carefully applied as above directed, has sufficiently softened the paper; but it is possible that when working in India at a high temperature, causing rapid evaporation, it may be requisite to start with the sheets in a moister condition; although, even in that case, it will probably be found expedient to trust to the freer application of a thin paste than to adopt the plan of soaking the sheets in water. In all cases, great care must be taken to keep one surface of the paper used for the first layer free from paste.

The papers for the succeeding layers are similarly prepared, except that in their case the paste is applied freely to both sides;

* It is found in practice that it is better to add the fibre at this stage, on account of its tendency to form knots if added at an earlier period.
and they are then rolled up and kept for some hours in a damp cloth covered with an oil-skin, as in the former case.

Having now got ready a convenient stock of materials, the operation of moulding may be commenced.

The first step to be taken is thoroughly to wet the portion of the sculpture to be operated on, this being essential to the perfect contact of the paper with the work. This, under the influence of the rapid evaporation which occurs in India, will involve the frequent application of water by means either of a sponge or a whitewasher’s brush, and it is for this reason essential that the work should be commenced at the top and carried downwards, as otherwise the water would be apt to get between the paper and the stone, and thus prevent the contact necessary for the production of a faithful impression.

The whole being now ready, the No. 1 paper, which has been prepared as already directed, is taken, and, as required, torn up into small irregular patches and applied to the surface of the work, care being taken to keep the side next to it entirely free from paste.

When the carving is slight, the pieces of paper employed may be of some size, but when it is bold and prominent they must, in order to avoid creases, be small, and the edge of each must overlap the other as slightly as possible. In order to prevent the joinings from being perceptible the paper must be torn up, not cut; besides, torn edges join not only more evenly, but also more strongly, than cut ones.

The first layer having now been laid on, and, to a certain extent, pressed with the fingers into the interstices of the work, the paper for the next layer is then torn up, and applied over it; and as soon as this has been done, the operation of sending the layers quite home to the surface of the sculpture is commenced.

This is effected by using pressure with the fingers, with brushes or modelling tools, &c., as may be best suited for getting every marking of the stone impressed on the paper. Upon the care with which this is effected depends, of course, the truthfulness of the mould and of the cast afterwards taken from it.

A continuous surface of paper, over a convenient working space, having now been obtained, the next operation consists in filling up any hollows of moderate depth* with the carton-pierre composition, which is to be kept at hand ready for the purpose.

When this has been done, all that is required, is simply to continue the application of the coarser pasted papers, layer after layer, until eight additional thicknesses, making ten in all, have been obtained. As an aid in ensuring the application of the required number of layers over the back of the mould, it is advisable to employ two papers of different colours, one a dark one, as by this means the operator will more easily know when he has completely finished the covering of the work.

In order to keep the mould in full contact with the work until it has become thoroughly dry in situ, it is necessary to use a little paste on the surface along the edges.

The next operation has for its object the prevention of alteration in the shape of the paper mould whether from “buckling” or other causes, after its removal from the work. This can best be effected by the free use of laths of some stiff wood, such as half sections of Bamboo canes perfectly seasoned, and not in themselves liable to warp.† Short lengths of these should be pasted down across the back with one or more layers of paper, or of canvas, or of coarse calico, in the manner best calculated to accomplish the object in view. The laths should be used freely, it being most important that the mould should retain its true shape.

* When the hollows are deep, it is inexpedient to fill them up with the carton-pierre composition. In such cases, the paper should be used in successive layers, until the proper number has been applied.
† It may, in the case of large moulds, be found requisite to use flat iron rods for this purpose.
In addition to the laths, as here recommended, it is also expedient to devise a method by which it can be readily ascertained if the mould has in any way deviated from its original condition in point of evenness, and at the same time of allowing it, if necessary, to be brought straight again. This can be accomplished by fastening on the back of the mould several blocks of wood which have in the first instance been carefully levelled when on the work. These, in addition to being glued on, might, for security, be pasted down under portions of paper, in the same way as the laths. In effecting this last operation it would be necessary either to leave spaces between the laths for the blocks, or to fasten these on first,—this last course being probably the more convenient one.

In cases in which the under-cutting is but slight, the paper mould, when dry, will draw freely enough from off the work, and this is one of the advantages which this process possesses over the use of plaster, either by itself or together with canvas.

When, however, the under-cutting exists to any great extent, it will be essential to take piece moulds in the usual way, using paper as before and filling up, when the depth is not too great, with carton-pierre composition to the proper level. In cases, however, where the depth is considerable, it is advisable to bridge over the hollows with card board. In every instance, care must be taken either to make a depression into the surface, or to insert one or more projections in the form of plugs, so as to determine the exact position in the cast of the piece-moulds thus formed.

The piece-moulds so formed should be allowed to remain in situ till dry; they must then be removed, treated with a solution of a marine glue, consisting of India-rubber and asphaltum in coal-tar naphtha, and, when again dry, they must be oiled and replaced before proceeding to complete the mould in the usual way.

In the gateways to the Sanchi Tope there is a great deal of sculpture which would have to be treated in this manner, and to which attention would have to be directed at starting, as the instances in question are to be found either at or towards the top, where, as already indicated, it is expedient to commence operations, with the object of working downwards.

When the sculpture presents two or more contiguous sides, like the pillars at Sanchi, it is recommended, in taking the mould of the side first operated on, to allow the paper to catch over the angles, and to be there slightly pasted, to make it adhere. This section, when thoroughly dry, may be removed, and the superfluous edges trimmed away. It is then to be treated with the marine glue solution, and, as in the case of the piece-moulds, replaced before the adjoining side or sides are moulded.

The paper employed in operating upon them is then worked on to, and made to overlap, the cut edge of the mould already taken, which will have to be kept in its place by spurs reaching from the ground, or such other means as circumstances may allow.

In cases presenting four sides, like portions of the pillars of the Sanchi gateways, moulds of the opposite sides may be first taken, and their edges being trimmed away, they may then be treated with the marine glue solution and replaced, previously to commencing operations on the remaining sides.

In the majority of instances, however, it will be found convenient to saw off the superfluous edge from the mould first taken, to replace it at the angle of the face to be next operated on, and then to mould carefully over its uncut edge.

In this way it would itself form the edge section of the new mould.

Such are a few suggestions as to the methods to be adopted in dealing with angles, where it is of such importance to secure accuracy.

The junctions of the different sections of the mould, wherever they may occur, have, however, to be effected in the same manner, i.e., it is necessary, in every instance, to work the edges of the new mould on to those of the one previously taken.
In carrying this out, the plan already suggested of using a fine saw to cut off the last portions of the old moulds, in order that they may become incorporated, so to speak, with the next one, will usually be found in practice the most advantageous.*

Should a large superficial area, suitable for moulding at once, present itself, it may be taken in one piece, which, when quite dry and hard, may, for convenience of packing, &c., be sawn into sections, each joint being marked with duplicate numbers, and care being taken, in all instances, to write inside what the subject is.

It is necessary to repeat, that the registration, or numbering and marking of the different pieces, must be very carefully attended to.

As each section of the mould is completed, the operation of drying will be materially hastened by allowing the sun to have access to it, and this, as already stated, may be done by removing the canvas or other material employed as a screen. This, therefore, should be so arranged as to facilitate the plan.

II. Process for making Composition Moulds.

As already indicated, this process consists in using the carton-pierre composition itself for the purpose of taking the entire mould, and it is one which will, in practice, be frequently found to answer better than that in which paper is the material chiefly employed.

It allows of moulds being more rapidly taken, and the tendency to "buckle" is very much diminished, whilst, with care in pressing it home to the work, the sharpness of the mould is superior to that obtained by the paper process.

In preparing the composition for application to the bas-relief or other object to be cast, it is rolled out upon a table or flat board,—which has been previously sprinkled with a little powdered steatite,—until it has acquired the thickness of from one eighth to occasionally even one fourth of an inch.

The sheet of material so formed is then applied to the surface of the work, which also has been previously well powdered with the steatite.

As in the former instance, the composition has then to be very carefully pressed, by means of the fingers or tools, up to the work. When this has been done, two layers of pasted paper, prepared as already described, have then to be applied over the back of the composition, and, as a precaution against "buckling," the strips of bamboo, &c., before alluded to, will, in certain instances, have likewise to be used.

In order to effect good joins between different sections of the same mould, it is desirable that the margins of the composition sheet should each be bevelled off and joined together with paste.

It now remains to describe, a little more in detail, the treatment of the moulds, with the view of rendering them impermeable to the action of moisture, and, consequently, capable of retaining their surface form, and thus of allowing a number of casts to be taken from the same mould.

As already indicated, this is effected by coating each section of the mould, when thoroughly dry, with a thin solution of a marine glue, prepared by dissolving india-rubber and asphaltum in coal-tar naphtha.§

In cases where the system here recommended is adopted, the marginal pieces, for incorporation in the mould to be next made, should be shorn off before the marine glue has been applied. In order to keep the pieces in question in situ at starting, as a precaution in aid of keeping the mould of which they are to form a part up to the work, it will be necessary to paste paper over the cut margin, so as to take a hold of a portion of the work, or that last moulded.

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One part of india-rubber is first dissolved in ten parts of naphtha, and then two parts of asphaltum, finely powdered, are added. To the solution thus obtained, about thirty parts of naphtha have to be added, in order to render it sufficiently thin to be applied to the mould. It is necessary that the varnish should be thin, both that it may enter the more deeply into the substance of the mould, and also avoid clogging up the finer markings which may exist upon certain kinds of work.

When the carving, however, does not present these, there is less care necessary in this respect, and two coats of the varnish may be applied with advantage.

The moulds should be rendered hot by exposure to the sun, and the varnish solution, also heated, must be carefully applied to their surface by means of a soft brush. The whole of the other parts of the mould should then be freely coated with the solution.

Instead of at once treating the moulds with the marine glue solution as described, it has been found advantageous to coat them, in the first instance, with boiled linseed oil and litharge; or sesanum or indian til oil, to which a little naphtha has been added, may be employed, as recommended by M. de Laval, in the description of his method which follows. In all cases, care must be taken to make the mould hot before either operation is effected.

It will, of course, in India, require every attention to prevent the access of white ants, or other destructive insects, to the moulds. Unless it should, on experiment, be found that the coating of marine glue acts as a sufficient protection, it will be expedient to try some other means of treating the mould so as to prevent their attacks. To this end, a solution of corrosive sublimate in the proportion of 40 grains to the quart of water might be used, or one of arsenic might be employed, but if any solution is employed after the mould is removed from the work, and before it has been made, so to speak, waterproof, it would have to be applied with care, on account of the tendency to "buckle," which would arise were the wet in any quantity to enter into the substance of the mould. Under any circumstances, however, it is important that the moulds retained for work in India should, when not required for use, be very carefully preserved, and it is desirable that valuable moulds, from which casts have already been taken, should be re-varnished before being stored away.

It has likewise to be noted that it may become necessary to repeat the application of the marine glue solution during the progress of casting, should the surface of the mould show signs of suffering either because an unusual number of impressions have been taken from it, or because of some original imperfection in the mould itself.

J. Forbes Watson.

The India Museum,
India Office, March 1869.
TOOLS USED IN PAPER-MOULDING.
NO. 1.
TO BE USED FOR FIRST AND SECOND LAYERS.

NO. 2.
TO BE USED FOR THIRD AND FIFTH LAYERS.

NO. 3.
TO BE USED FOR FOURTH AND SIXTH LAYERS.
I refer here to operations which the traveller must perform in the desert, but if he finds himself near a town he may procure the oil of sesamum. It answers perfectly, and dries well, especially if a little naptha is added to it. It is to be found in Persia, Russian Asia, India, Arabia, Syria, and Egypt. The moulds are coated lightly with these substances, and are then exposed to the fire or to the heat of the sun, which will cause the fatty matters to sink well in, and so prevent the rain or damp from acting on them, which is essential for such fragile, and to all appearance, permeable articles. In France and throughout Europe boiled oil may be obtained, or instead of it some bees wax may be melted in linseed oil and the moulds coated with this.

III. To render Moulds of large Bas-reliefs portable.

It would be impossible to carry the moulds of large bas-reliefs entire with safety through wild countries, as the capacity of its poorer inhabitants would be excited by the sight of so much baggage, besides which, the packages themselves would be very awkward and expensive to carry about; some means must, therefore, be devised for rendering them more portable, and capable of being packed into boxes of about 5 feet long, 2 feet wide, and 18 inches deep. When the subject admits of it (such as an inscription) the cast should be cut into strips between the lines with strong scissors. The strips should be cut to about the breadth of the box, or any other convenient width, according to the nature of the subject. Such strip should be numbered and marked with register points with a lead pencil, using one or several strokes as may be necessary. When it is required to cast them in plaster, they must be brought together in the mould, the marks of the joins will be visible, but it is very easy to remove them while the plaster is fresh, either with the nail or with a moistened ear of the doghound fish, which is used by all moulders. As regards large bas-reliefs or colossal figures, the principle is the same, discretion being used as to whether to cut along the relief or through the ground; the deep parts will join well in the modelling.

Casts of very large inscriptions in shallow characters will only require three or four sheets of paper, and may be folded up, taking care that the longitudinal folds may come upon nearly vertical letters, if possible. Another precaution, which should be taken by all travellers, is to write inside each mould, as soon as it is taken down, where it came from, and the character of the work, otherwise it will be found impossible to recognize the numerous subjects which may have been collected together.

IV. Baking the Moulds.

This is an operation as delicate as it is important, since it might entail the destruction of precious moulds which it would be difficult to replace. It need not be done while travelling, but it is better to do it at once.

The moulds are placed in front of a large fire-place, in which a very hot fire is burning. They should be supported in a vertical position by means of chairs, &c., in order that they may be placed as close to the fire as possible. When the mould is scorching take it away, and coat the inside with the following mixture:

Thick boiled oil - - 500 parts.
Beeswax - - 50 "
Turpentine - - 50 "

These materials should be mixed in an iron pot, and applied while quite hot with a broad brush. One coat is sufficient. The moulds are then placed in an oven heated to 180° or 212° F. They are left there for half an hour. In default of an oven they may be placed in front of the fire as before, but a free current of air must be maintained in order to
drive off the unwholesome fumes which will arise and are liable to cause colic and inflammation of the throat. These operations being completed, you may proceed to cast in plaster.

A remark may here be made, that the older the moulds are the better they get.

V. Impermeability of the Moulds.

The moulds may be made perfectly watertight by coating them outside with the same composition. This is done after all the other processes, and the inside is again exposed to the fire.

VI. Repairing the Moulds.

It constantly happens that the moulds blister or strip in places. The first leaf of paper applied at the beginning of the operation rises up with a thickness varying from \( \frac{1}{4} \) in. to 2 in., and that even before being used. There is no necessity to trouble oneself about it at first, and especial care should be taken not to apply any paste to it, because, when it is baked, the part newly pasted will wrinkle or form ridges. No repairs should be made till all the preceding operations have been gone through, and you are about to cast in plaster from the moulds. You then proceed as follows. The mould must be laid on the modelling table, and is coated all over with a thin coat of linseed oil to which has been added one-sixth of boiled oil, after which dip a flat brush, about 2 in. wide, in flour paste, and pass it gently under the raised leaves, working it with the fingers till it sticks, then run on the plaster, without waiting for the paste to dry.

Sometimes, when casts of objects in slight relief, or very shallow inscriptions, are made in desert places, under a burning sun, the outer part getting dry very quickly causes cracks or ridges; this usually happens when the moulds are made of one or two sheets of paper. Nevertheless, these moulds should undergo all the operations above described; only, before running on the plaster, take a wet sponge, and dab the inside of the mould with it gently; after a few minutes the mould will regain its proper shape. Then coat it with a mixture of raw and boiled oil, let it dry, and all the ridges will have entirely disappeared.

Casting in Plaster.

Such light moulds being unable to support the weight of the large masses of plaster required to make casts from them in the ordinary way, especially if the relief is strong, some other device is necessary.

When the bas-relief is to be cast in plaster from a deep mould, spread on the modelling table a layer of plaster equal in height to the greatest depth of the mould; on this bed place the mould, outside downwards, and allow it to settle down in the plaster. Then with a little board, or the scraping triangle of masons or modellers, work the plaster up, and press it well all round the mould, until it is as high as the ground; then surround the bas-relief with long wide rods, placed so that they may be easily removed when the plaster is set. They must be supported at intervals either with bricks, stones, or pieces of wood, in order that, when the liquid plaster is poured in, it may not knock them down. The thickness to which the plaster should be poured on varies according to the nature of the work, which practice will soon teach.

The casts may also be made in Roman cement, or any of the materials used for modelling.

They may also be bronzed and coloured according to taste, but should first be coated with the mixture of boiled oil and turpentine described in IV., applied after the casts have been warmed.