THE TREATMENT OF SMALL ANTIQUITIES.

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Though the private collecting and custody of antiquities is now so general, yet there are no simple directions published for the processes so often needed for their treatment and preservation. And though objects of great value had better be entrusted to a professional cleaner, whose higher secrets—especially in the treatment of bronze—I cannot profess to know, yet there is always a large number of antiquities which the amateur may safely develope from the encrustations which hide them. Broadly speaking, all dirt—that is encrustations of all kinds which are not derived from the material beneath—should be removed entirely; while compounds formed from the material itself should be more or less removed, according to the extent to which they hide the original work. The ultimate object being to shew as much as possible of the workmanship in as pleasing a manner as may be, but in no case to destroy or alter any original feature.

It is hardly needful to say that all attempts at completions or restorations of parts, or any tampering with coloured parts, or touching up, or addition of colour, is absolutely inadmissible. No skill and no necessity can justify these falsifications, only such losses as altogether change the proportions or effect should be compensated; as, for instance, if the legs of a figure are missing, the need of proportion may be supplied by a plain block, not obtruding beyond the original outline. Such simple alleviations of misfortune, which can never mislead the eye, or irritate the judgment, are all that may be reasonably made. In some cases it is a useful aid to the appreciation of figures that are much damaged, if a modelled restoration of the original is placed by the side of the ancient fragments. When inscriptions or designs are but faintly incised a little colour much improves their visibility; such addition, however, should never be painted in (as on some inscriptions in the Louvre), but should be merely a loose powder—chalk or charcoal—rubbed into the hollows, and capable of being cleaned out again. Such a powdering fairly shews original features without adding any falsity of restoration.

Generally speaking cleaning is done by dissolving encrusted compounds by means of acids or alkalies; and in naming those acids most commonly used—sulphuric (or oil of vitrol), hydrochloric (or muriatic, or spirit of salt) and nitric (or aqua-fortis), it must be understood that they should be nearly always diluted with from five to twenty times their bulk of water: the weaker the mixtures the slower and safer is the action; but as the strength is, of course, diminished by all the solution of metal

which takes place, weak acid requires strengthening more often than stronger mixture. Small touches of pure acid are often useful if carefully applied to bad places, so as to equalize the surface for general treatment.

It is important to notice the principle of the formation of compounds from the original metal in bronzes, and other copper alloys. The compound, or patina, is not usually formed out of the surface metal, but is of metal drawn by slow action out of the whole mass. A metallic object is not homogeneous, but is made up of a multitude of minute crystals of pure metal, and of the various alloys formed by the impurities or intentional additions which are present. Thus there are particles all through the mass which are more oxidizable than their neighbours; and these, forming a galvanic action with the less oxidizable, are—in the very slow course of rusting—transferred to the surface; there they accumulate as a crust of compound on the face of the more resisting metal. Thus a deeply patinated bronze is like a sponge, the pores of which being insufficient to hold the compounds which have been formed, these latter are forced to the surface, and there form a coating on the original face. This view explains the brittleness and dull fracture of patinated bronze, which, nevertheless, appears to be entirely metallic if it is rubbed or burnished; it also explains how a face of metal which shews the most delicate markings may be found beneath a deep crust of compounds formed from the metal. It is only in a badly advanced stage of decay, or a rapid corrosion, that the face of the metal begins to yield, becoming pitted and finally lost.

For cleaning gold—which is unalterable, unless largely alloyed—nothing is needful but the removal of foreign matter; and this may be done by any acid, or by ammonia, if chloride of silver be on it. An alternation of acid and ammonia is often needful to remove mixtures of compounds. Above all, care should be taken not to rub or brush gold, since its softness allows the surface to be quickly damaged, and the dull yellow of ancient gold is irrecoverable. It is often needful to unfold gold-foil ornaments, and to remove their creases; but if any undue pressure is applied the gold is expanded and buckled, so that it will not lie flat again. This unfolding should be done rather by bending between the fingers instead of by pressure; and if a flat squeeze is needed to remove a crease, it is best done by a blunt bone edge, while the gold foil rests on leather. Gilt metal objects are very tender, as the gilding is merely sticking to the patina beneath; the best way is to clean them piece-meal in the hand by touches of strong acid, carefully watched; washing the acid as soon as the gilding came clean at any point. The use of coats of varnish, or wax, on parts that are not to be attacked, is dangerous; action may take place under or around the coat, and the parts differ too much in appearance from the surrounding surface. It is generally better to work down the patches of thicker encrustation by touches of strong acid, or even by scraping, chipping, or filing; and then finish by unifying the whole appearance in a general bath of weak acid.

Silver is almost always altered more or less into a dark grey chloride, or occasionally sulphide; and these compounds may be distinguished from other encrustations by their soft toughness, which allows them to be cut by a knife. Beside this change the silver itself becomes brittle; not really crystalline, but breaking up into irregular little grains with

curved surfaces, which have scarcely any cohesion, though not containing an appreciable amount of any compound. The surface compounds generally contain some encrusted carbonate of lime, which need alternations of acid bath to dissolve them. For delicate silver objects, such as grain jewellery, nothing can be safely done beyond removing lime by weak hydrochloric acid, and dissolving the chloride with strong ammonia, so far as is safe, without loosening the small parts. From more solid objects, as seals or coins, the chloride may be all dissolved by ammonia; but this is liable to also dissolve out the chloride from the face of the silver beneath, and so leave it rough and broken up. The safer plan is to reduce the chloride to metallic silver; this is done either by placing it along with metallic zinc in a weak salt solution for a few hours, or along with iron nails in lemon juice. Either way the chloride is reduced to powdery metallic silver, and may be brushed off or flaked with the finger nail; or, if still sticking on, it can be loosened by a touch of strong nitric acid. Alternate weak hydrochloric is often needed to dissolve out any lime.

Copper, bronze, and brass involve a question of taste in their treatment, more than any other material. How far they should be cleaned must depend not only on their state, but on the appearance desired. At one national museum everything is stripped off down to bare metal, which is then darkened by smoking and oiling; the result is far from happy, as might be expected. It should be remembered that green or blue carbonate of copper is almost worthless as a guarantee of age, as it can generally be put on; but the hard red oxide of copper, especially if thick and firm on the metal, is never imitated. Occasionally bronzes are in the happy state of needing no cleaning; as, when the patination is but slight and perfectly regular, the details may be as fine on it as on the fresh metal, especially if the compound has been formed from the surface metal. Generally, if a mass of compounds have to be cleaned away, it is best—on a statuette, for instance—to clean the face and detailed parts down to the metal, while leaving some of the red oxide with spots of green carbonate to brighten it upon the plainer surfaces of the trunk and limbs. Some amount of red patina gives, not only a guarantee of age, but also a proof that the bronze has not been over-cleaned or tampered with.

Bronzes may be roughly put in three classes. (1) Those with a scale of oxide and carbonate which is readily cracked off from the metal below; this may be removed by light blows from a hammer upon the scale, sufficient to bruise it up without indenting the metal beneath. Sometimes it needs to be crushed up piece-meal by hammer and punch, using soft iron wire nails, so as to run no risk of cutting through to the metal. Another way of loosening the scale is by heating the bronze nearly red hot, and quenching it suddenly in water. Some mode of scaling is always desirable, if possible, as it leaves the surface in a finer state than by any other process, without any rubbing or corrosion, and often beautifully frosted over with red oxide of copper. (2) Those bronzes with a firmly fixed scale of oxide and carbonate, which must be dissolved. Hydrochloric acid for some days or weeks is the proper solvent for these; occasionally nitric acid is required, but it is dangerous, as it attacks the metal as readily as it dissolves the scale. With hydrochloric acid, however, a coat of white oxy-chloride of the metal is formed, which

is troublesome to remove, so as to leave a good tint on the metal; strong hyposulphite of soda is the best solvent for it; if used hot and strong it will leave a bright surface of metal, but short of this it leaves a good bronzy face to it. At all stages plenty of stiff brushing is desirable. (3) Those bronzes which shew cracks on the surface. These are nearly all uncleanable, the metal below being broken up by carbonation, and no original face remaining. Burnt bronzes, with the patina turned to black oxide, are also uncleanable, and must be left as they are. Where green carbonate alone has to be removed ammonia is a good solvent, as it cannot injure the oxide or metal. The old-fashioned vinegar, or acetic acid, is not bad, but it is expensive and slow.

Lead had better be left alone in nearly all cases. It should be never brushed or washed; but it may be soaked in plain water to remove salt, without any injury. If a solvent is required acetic acid is the best, as all the mineral acids, when diluted, make insoluble compounds with lead.

Iron things, if at all split, cannot be cleaned any more than split bronzes. The only treatment is a good soaking in water, to remove soluble salt, baking in a hot oven, and then long soaking in melted wax, which should be left in all the cracks and pores when the metal cools. If the iron is still metallic with spots of rusting, it may be cleaned by immersing it, when quite dry, in strong fuming nitric acid; this—strange to say—will not attack the metal, but only dissolve the rust.

Antiquities are often saturated with salt, especially those from Egypt; and it is needful to soak them in two or three changes of fresh water. Any sort of material may be soaked, bronzes, stone, pottery, clothing, ivory, wood, painted objects, and even unbaked clay, and paper squeezes. For porous objects, not over $\frac{1}{8}$ in. thick, a day suffices; but for partly-glazed objects and thick masses, weeks, or even months, may be needed. It should be always remembered to place painted things (such as tablets, or ink-written ostraka) face upward, and to remove such very slowly from the water; also that no limestone or pottery face should be brushed when wet, unless necessary, as brushing removes the finer particles, and leaves a raw rough surface. If there is no taste of salt on the face when the object is dried again, it may be considered fairly clean. Salt, and especially salammoniac, is most destructive to copper and bronze; it causes a continual action by attacking the metal, and then exchanging with the carbonic acid of the air, and proceeding to eat into fresh metal, until a small trace will at last destroy a bronze. This may be detected by its forming a bright yellow green, loose powdery, or flaky carbonate, which is easily rubbed off. Long soaking is a complete remedy for this; but it is as well to clean off the carbonate, first by sulphuric acid, so as to leave less cover for the salt.

Limestone often turns powdery on the surface, generally due to salt in it; and if it is then oiled it makes an irretrievable mess. After water-soaking it should be coated hot with rice water or tapioca water, to bind the surface together. Pottery seldom needs any treatment, beyond soaking to remove salts; encrusted lime on it may be flaked off or dissolved by acetic or dilute nitric acid; soaking afterwards to remove the acid. Often, the finely moulded, or even modelled, terra-cottas of Roman age are disguised by a thick coat of plaster, which was laid on to receive the colouring which has been since lost; this hides all the finer detail, and it is as well to flake and wash it off mercilessly, and so recover the delicacy of the work.

For bronzes a thin coat of oil or varnish is often needed to finish the appearance; but such a coat is usually applied far too thickly. If oil is used a thin solution of some old tacky linseed oil should be made in benzol; and this, or thin varnish, should be applied coat over coat as each dries, until the bronze just begins to shew a little glazyness in parts. Thus the right amount is laid on, just short of glazing the surface; and stiff brushing will finish the work.

For mending broken objects there are innumerable recipes; but shell-lac in spirit is agreed to be one of the best. Some say that a special marine glue is more permanent; but as vases joined with that sometimes drop to pieces in damp weather, the shell-lac seems safer. The great point in making a good joint—after having the surfaces quite clean—is to use the varnish very thick, so stiff that it will only just draw out in threads; then, by moistening the surfaces with spirit, before applying the varnish, it is thus liquified at just the necessary part, while the surplus on pressing the joint together is squeezed out too stiff to run on the face. Generally only one joint at a time should be made and hardened before making another. But often it is needful to secure a joint quickly; and this may be done by warming it with a spirit flame, so as to boil out the spirit; if a large piece, the joint may be thus roasted in any position by a blow-pipe. When joints are not thus done, the hot pieces must be set to dry on edge, the lesser piece standing on the greater, irrespective of the strength of cement until it is set. Thin india-rubber bands, placed superposed, are also very useful to hold pieces in contact; and by putting in struts of crushed paper beneath the bands on the convex sides of joints in curved pieces, the pull may be equalised on the two sides. Hot stiff tapioca I have used for joints of pottery in default of anything else; it is so far quite successful, and, being colourless it deserves further trial. A clean face, a perfect fit, and a close joint, are the three essentials for success in mending anything.