if blown up to a large scale of some contemporary paintings, would rank as modern masterpieces. Yet the painting under observation may itself be insignificant and the microscopic view may cover less than one-half inch of background taken out of context.'
Mr Kelly is obviously a painter himself. He is also an amateur intrigued by restoration. Had he written his book consistently from this superficial point of view, his contribution might have been a charming diversion.

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H. J. PLENDERLEITH and A. E. A. WERNER, *The Conservation of Antiquities and Works of Art*, Oxford University Press, London 1971, XIX + 394 pp., plates 46, figs10, £ 6·50.

This second edition of a book that has been translated into many languages and used literally world-wide has been extensively revised in the course of gaining a second author. Quantitatively it has gained twenty pages of text, including five appendixes and some references, but it has lost nine plates and a figure. A number of its original plates have been replaced by others. Some of these illustrate methods developed in recent years. Others newly illustrate the problems of glass. This is an improvement: the new selection of plates and figures is better distributed over the many topics discussed in the text. The extra appendices should prove particularly useful because they are concerned variously with: the toxicity of organic solvents; differences between United States and United Kingdom usage of nomenclature and units; the much-used soluble nylon; the recently devised circuit for consolidative cathodic reduction of silver.
It is proper for the present reviewer to declare his interest before proceeding further. He has himself worked in the British Museum Research Laboratory, whence comes much of the material. Nevertheless, his present activities are so distant and different that a detached viewpoint is practicable. The following comments are intended particularly to help readers who work in American areas of influence, but they will also indicate something of the content of the book for anyone who happens to be unfamiliar with it. The subjects of comment have been discussed with the authors, but not this actual text.
The Hygrometric Chart shown in Fig. 1 of the book is more than an illustration: it can actually be used to solve practical problems. However, computation can be made easier for users of the metric system — all of us in the not-too-distant future — if it is remembered that 1 grain per cubic foot is equivalent to 0·0648 gram per cubic foot or to 2·29 mg per litre. For use in dry climates it would have been helpful to include lines representing relative humidities lower than 30 per cent. Some readers may also wish to add degrees Celsius to the dry-bulb scale, available from Appendix VII, although described there as 'Centigrade', a term superseded since the 9th General Conference of the International Committee of Weights and Measures, 1948.
Inhabitants of the less temperate climatic regions of the world may find difficulty in complying with the recommendation of 50 per cent as the lower safety limit of relative humidity for organic materials: their buildings cannot contain so much moisture safely during freezing weather. In fact, a lesser lower limit has been found to be satisfactory provided that ob-

jects brought in from other climates have been allowed to acclimatise themselves to the new conditions extremely slowly.

The injunction to plan a method of conservation that will not cause loss of essential characteristics indicative of the age, authenticity or provenance of the object accords perfectly with the Code of Ethics formulated in 1968 that has now been adopted as a condition of membership by the American Institute for Conservation, previously IIC-AG. The diagrams intended to assist conservators in their planning of technical treatment have been retained at the ends of the chapters on various metals.

In descriptions of insecticides there is no mention in the text of the present-day legal regulation of sales of DDT, nor of the health risks asssociated with regular use of carbon disulphide and carbon tetrachloride. If the reader seeks, he will find a new Appendix III on the toxicity of organic solvents.

Present-day inability to use certain inexpensive poisons freely does, however, make problems for museums. They may instead choose to sterilize objects in elaborate gas-fumigation chambers. Use of these will sometimes necessitate temporary storage of the objects in the cellophane bags (currently made more usually of polyethylene) that are also suggested. The sealing recommended involves no risk if the climate of the whole museum is properly controlled, but if it is not, then it must be remembered that there is a risk of condensation when passing through areas of lower temperature. The possibility of risk in any actual situation can be assessed by intelligent use of the authors' Fig. 1.

Some slips in proof-reading are evident. For example, 'adsorb' on page 50 should read 'absorb' and the name 'Perriman' in the footnote on page 149 should read 'Penniman'. Several references to 'Topanews' are errata for 'Topane w.s.', meaning the water-soluble sodium salt of orthophenylphenol. Other startling usages, such as 'et sqq.' in place of 'et seq.' or 'et seqq.', and 'gm' in place of the American standard and Système International 'g', representing 'gram', are to be attributed to the house-style of the Oxford University Press. The first edition lacked these affectations.

Another apparent oddity, in a procedure for fumigating a room with formaldehyde, is a quotation from an American Chemical Society Monograph. In this the formaldehyde solution is measured out by weight, despite the fact that it is more easily measured by volume and indeed is sold by the pint. The statement in this form does, however, prevent misunderstanding that could arise from the fact that the U.S. pint is smaller (four-fifths) than the Imperial pint, as stated elsewhere, in Table V.

A convention important to note is the special usage of 'per cent' explained in Appendix I. Clearly intended for the non-chemist and easy to understand, it actually results in so-called '10 per cent hydrochloric acid' containing 3·5 per cent of HCl and so-called '10 per cent nitric acid' containing 7·2 per cent HNO_3. As a result, one cannot take equal volumes of dilute acid and alkali from the shelf and know that their mixture will be neutral (pH 7). In treatments where pH is important this non-standardization could be a hindrance to high-quality work.

The statement on page 53 that carbon tetrachloride fire extinguishers are perfectly safe should not be read out of context. Although, as stated, safe for application to parchment documents, these extinguishers are NOT safe for humans. Anyone still housing sealed glass spherical extinguishers — they are sometimes to be found in odd corners of long-established workshops, painted red — or the antique type of vacuum electric lamp that, burned-out, was filled with carbon tetrachloride to serve the same purpose by pinching off its 'pip' while held under the liquid, would be well advised to dispose of them. An alternative less-hazardous liquid having similar properties is trichlorotrifluoroethane (Freon 113).

Passing to considerations of paper. a number of methods of deacidification are described. It would have been instructive here, in view of the warning against alkalinities above pH 9, if the pH values attained during the treatments could have been stated, together with their durations during the various stages.

In a discussion of uses of impregnated paper, fungicidal sheets are advocated for insertion between documents wetted by accidental flooding. It would have been helpful at this point, although strictly not appropriate, to mention the use of freezing as a method of preventing growth of moulds. Advocated by Carolyn Horton a decade ago as an emergency measure, subsequent drying by sublimation of the ice ('freeze-drying') has sometimes even resulted in separation of adjacent sheets of art paper, usually impossible to separate after soaking.

'Fortnight', the suggested minimum time for exposure of insect-ridden manuscripts to paradichlorobenzene, is an anglicism, a contraction of 'fourteen nights', meaning two weeks.

A commercial preparation named Insecta-Lac is suggested for the lacquering of storage shelving, without naming a source of supply. A formula quoted in *The Conservation of Cultural Property*, UNESCO 1968, page 68, may prove satisfactory and still respect health laws if DDT is replaced by Methoxychlor, and Aroclor (a chlorinated biphenyl) by ethyl cellulose.

Later, soap is suggested as a possible cleaning agent for paper but without further qualification. In view of the wide range of soaps on the market, compounded with colour, perfume, antiseptic, emollients, alkali, fortifiers and other additives of dubious benefit to paper, it would be wise to read 'soft soap' or at least 'neutral white soap' (perhaps Ivory) in this context.

A section on the bleaching of stains from prints describes three methods and contains much good advice. However, since the time at which this work was revised there has been developing a considerable scientific interest in the very long-term effects of such treatments. Final conclusions have not yet been reached, but there is evidence that use of antichlor should never be neglected and that a compound other than the suggested and much-used sodium thiosulphate might be preferable. Furthermore, the very controllable and popular chloramine-T method may have long-delayed effects unless the reagent is thoroughly washed out during many hours. In bleaching by hydrogen peroxide, using non-ethereal methods several workers have found serious degradation of the paper. Some of this may be attributable to the use of commercial dilute solutions which in the U.S. contain various stabilising substances. This possibility is mentioned later, on page 87. The difficulty may be avoided by purchasing 95 per cent hydrogen peroxide, said to be free from additives, and diluting appropriately. The user should observe all of the precautions recommended for this unstable material. Indeed, concentrations lowered to one-tenth or even one-hundredth of those specified here seem to be desirable if damage to the paper is to be avoided.

Leaving paper for the subject of textiles, the space available has been very well filled with data on cleaning, stain-removal, fungal and insect attack, repairing and mounting, protection in storage and exhibition, embroidered textiles and archaeological textiles. These latter titles have been completely revised or are new, but a complete account of treatment of all textiles cannot be encompassed in twenty-four pages. It is astonishing how much has in fact been included. A few comments can be made usefully as follows. Saponin is toxic and its solution should not be allowed to come into contact with open wounds. 'Batter' in cloth is an impregnant applied by the manufacturer to stiffen it. Protracted exposure to the vapour of paradichlorobenzene insecticide will soften and make sticky the surfaces of

clothes-hangers made of some of the modern plastic materials and of wood that has been varnished with shellac.

The section on wood is as varied as that on textiles and does serve to give a rapid overview of the subject, with descriptions of representative methods. Individual readers with experience and who work in a less well-controlled museum may hold different opinions on some subjects discussed. For example, a craftsman might use hide glue in preference to any of the synthetic resins listed, especially if he anticipated having to remake a joint at some future date. Furthermore, the use of a linseed oil–turpentine–vinegar mixture as a cleaner and polish is recommended in moderation. This advice is seldom heeded as written, nor the housekeeper's injunction to 'rub off more than you put on'. As a result, furniture may darken after decades of treatment because of a slow build-up of ageing linseed oil. It would be preferable to suggest a non-drying oil.

In the description of the alum process for waterlogged wood it is good to find potash alum defined by formula. The earlier reference to alum size in paper lacks a formula. In fact, it concerns the simple aluminum sulphate.

It is a pity that the substances poly(ethylene glycol) are associated with the word 'wax'. Although their solubility in water is here made perfectly clear, individuals have been found to use the material mistakenly on iron objects in place of paraffin or microcrystalline waxes, with the inevitable consequence that rusting was accelerated instead of prevented.

Next, a note on the chapter on ivory. The 5 per cent solution of soluble nylon in ethanol suggested here as having a matt surface has been found sometimes to yield a sheen. Much depends on the nature of the substrate: if absorbent, the consolidant will appear matt; if non-absorbent, it will have a sheen. Preliminary experiment will allow change to a weaker, say 2 per cent, solution if necessary.

Control of relative humidity by use of a suitable chemical is described on page 157: a list of the actual chemicals appears nowhere except in the footnote on page 3. Direction to this location could usefully have been inserted in the text in the unused half-line: the index is not particularly helpful in this matter although generally better than in the first edition.

In discussion of the cleaning of jewellery inlaid with shell and coral there is a welcome warning against the use of acidic cleaning agents, without, however, a note that the widely used silver dips are all acidic in nature.

The chapter on easel paintings is as comprehensive as other chapters, within the space allotted. The new writing leaves out trade names, so it becomes less immediately useful. Who, for example, without trade name or laboratory guidance, could select a 'polyvinyl-acetate emulsion' adhesive from among those offered over the counter? The deletion does, however, imply the general problem — that manufacturers are under no compulsion to continue a particular formulation, or to change the name when they change the formulation, with the result that formula XYZ: 1956 may differ entirely in material and consequently in long-term stability from formula XYZ: 1971, sold to serve an identical short-term purpose. A practical example is that of 'Calgon', recommended three times elsewhere in the book. This product is now sold in supermarkets in a 'new improved' version that contains less of the ingredient actually needed by the museum worker. He must now turn to the chemical supplier, unfortunately less accessible than the store.

Part II, on metals, is again a major portion of the book. The material is largely identical with that of the first edition except for rearrangement and insertion of newer methods such as the electrolytic consolidation of mineralized silver and lead, the stabilization of corroding copper alloys by means of silver oxide or benzotriazole, the cleaning of lead by chelation and the use of powered tools for mechanical cleaning.

In the condensation inseparable from so encyclopedic a work some useful practical detail have been lost. For example, the method described for the cleaning for re-use of granulated ('mossy') zinc after apparent exhaustion in electro-chemical treatment is tedious. More satisfactory results can be achieved by melting in a ladle under a reducing gas flame and pouring into water. Again, in an initial general description of electrolytic reduction, the need for proper distribution of anodes is not emphasized. We know that the whole of the corroded surface of the cathodic object must 'see' anodes. For this reason a suitably shaped anode may even have to be installed in cavities in hollow objects. The use of stainless-steel anodes is also advocated without note of attendant difficulties: that because the anode is usually unreactive, allowing chlorides to build up in the electrolyte, the liquid must be replaced very frequently; that if low current densities are used the 'stainless' alloy may actually corrode, a condition correctable by reducing the total area of the anode but distributing the lesser area as numerous smaller anodes all around the object.

The paragraphs on soldering fluxes are still a little disappointing. On careful reading the essential warnings against use of acid chloride fluxes are clearly expressed, but the mere mention of 'Baker's Fluid' and 'Arax' lends countenance to any craftsman who already leans heavily towards such short-term aids, neglectful of the subsequent disastrous corrosion. Now that there are so many excellent organic adhesives available it would surely be wise to advocate their use to the exclusion of soft solders (lead solders) altogether.

A reference to the use of silver nitrate solution for the removal of films of copper from silver neglects acknowledgement to Earle Caley who reported experiments with the method in *Technical Studies*, 3, No. 3 (1935), 122–132.

If conservators are not to be disappointed, a few more lines should be added to the description of the toughening of a silver alloy that does not respond to annealing at 600°C (p. 234). The heating must be carried out for an adequate time while the silver is embedded in wood charcoal, and then the whole, charcoal and silver together, quenched in cold water. Reshaping must then also be carried out without delay, while the silver is at its softest, because precipitation-hardening may occur within ten days at room-temperature. More information on this subject will be found in *Application of Science in Examination of Works of Art*, Museum of Fine Art, Boston 1965, pp. 99 *et seq.* and 131, a reference that could usefully have been added.

In the chapter on copper alloys there is a possible slip on page 250, where the formula for alkaline glycerol measures the liquid glycerol by gram. This can be done, of course, especially when the balance has just been used to weigh out solid caustic soda, but measurement in millilitres is usually easier and then gives the correct ratio, 50 ml to 150 gram, in contrast to 50 g, which actually occupies 40 ml and then requires only 120 g of soda.

Many references occur to commercial chelating agents similar to EDTA (ethylenediaminetetraacetic acid). This same substance is available as Versene Acid (Dow Chemical) or as Sequestrene (Geigy). The disodium salt (Titriplex III and Disodium Deterate) is apparently not available in U.S. in the Versene series but can be obtained from Geigy as Sequestrene NA2 or described as the disodium salt of EDTA from the Fisher Scientific catalog. Detarol (trisodium salt of N-hydroxy-ethylene-diaminotriacetic acid) corresponds with Versenol 120; Detarex HM probably with Versene Fe3-Specific [N-N-di(2-hydroxyethyl)glycine]. Versene powder, Versene liquid, Versene 100 and Sequestrene NA4 all contain the tetrasodium salt of EDTA in various concentrations. The acid and the various salts naturally have different values of pH and of solubility in water. These factors have been considered in the recipes. It would have been helpful here if it had been pointed out that only the

EDTA acid need be stocked, and that the two sodium salts can be made as needed by dissolving it in the appropriate amounts of sodium hydroxide.

The chapter on stone has been lengthened and considerably revised by insertion of contemporary ideas. Again there are a few difficulties of nomenclature. The effective ingredient in Nitromors paint-stripper is methylene chloride, and alternative commercial strippers should be selected with this in mind. A reference to white glue has fortunately been defined by content: the same name is now applied sometimes to emulsion or latex adhesives which also are white in color. Soluble nylon has also wisely been qualified as Calaton CB. Several other soluble nylons on the market do not have the same properties. For 'methylated spirit' read de-natured alcohol of the isopropanol- or methanol-containing varieties, for example, Solox, but see also Appendix IV.

One useful gap-filler omitted from the section on repair of pottery — perhaps more useful even than AJK dough — is Polyfilla, a plaster-like substance containing a substituted-cellulose adhesive, unfortunately without equivalent in U.S. but available in Canada.

The problem of finding a supplier for small quantities of unusual substances has been faced in this edition by incorporating a list of them. Naturally, all of them are located in England, but a few small firms there are prepared to export, notably Picreator (address listed) and Frank W. Joel, 9 Church Manor, Bishops Stortford, Herts, England (not listed). A U.S. source of materials needed for treatment of paper and books is: TALAS, 104 Fifth Avenue, New York, N.Y. 10011.

This second edition is as important as the first was in 1956 because it presents its subject without difficult reading in one wide sweep. For this reason it is essential reading for any would-be conservator. Yet in a way this attribute has become a weakness. Conservation treatment has advanced so much that there are now many more methods than can be condensed into a single volume, each attuned to some particular need of an ailing object made of some one or of many different materials. It used to be possible for a challenged conservator to reply simply: 'But I followed Plenderleith'. Now one has to ask: 'Which part of Plenderleith and Werner? Did you not observe A, B, C, . . ? Would it not have satisfied the need better to have used X's method?' (not even noted in P. and W.) We must anticipate future textbooks that confine themselves to specific subject-areas. We must hope that they, also, will be written by practical people who understand the problems at first hand from their own experience. Meanwhile we must be cautious in using this edition, being careful not to lift statements from their context, reading all of the text on a given topic, in order to understand the implied restrictions on any particular method before putting it to the test.

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