Conservation of Folk Materials : Desalination and Other Treatments

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Conservation of Folk Materials: Desalination and Other Treatments

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ABSTRACT: Folk museum collections are a source of considerable problems, since such artifacts invariably consist of many different materials, which through usage are often in poor condition. In this report, the problems of the deterioration and conservation of folk materials are discussed with special emphasis on iron and iron composite artifacts used as fishing implements and for salt-making. The conservation process includes dirt- and stain removal, desalination, coating, anti-corrosion treatments, and consolidation of fragile components. Special emphasis is placed on the problem of conserving iron jointed to organic materials.

[**KEY WORDS:** FOLK MATERIALS, CONSERVATION, FISHING IMPLEMENTS, CLEANING, DESALINATION, COATING, CONSOLIDATION, IRON/WOOD, MOTH-PROOFING TREATMENT]

1. INTRODUCTION

The preservation of folk materials is particularly problematical, in large part because artifacts consist of many different materials. The principal problems encountered are the deterioration of organic materials owing to the action of insects and fungi (Fig. 1); loosening and collapsing of wooden tubs (Fig. 2); and corrosion of ferrous materials and the effect of this on other materials (Fig. 3).

Artifacts such as fishing implements and tools for salt-manufacture, that have been used in sea water and on beaches, deteriorate rapidly. Prior to entering museum collections, they are usually rusted and corroded (Fig. 4). Once in museum storage they rust continuously, to the point of decay.

This report describes the conservation treatment applied in 1974–75 at the Gangoji Institute for Research of Cultural Properties to a collection designated as being Important Tangible Folk Cultural Properties [MASUZAWA 1981]. This was the first attempt in Japan to conserve folk materials. Designated collections of fishing implements have been conserved and restored in our institute since that time.

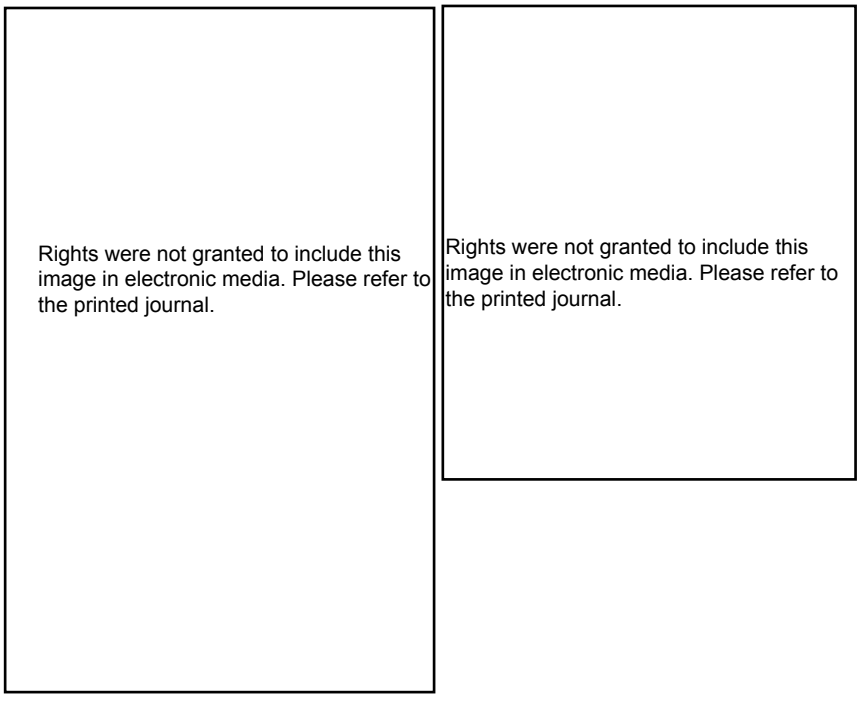


Fig. 1. *Zori* (sandals) made of bamboo sheaths. The straps of the *zori* are made of straw and decorated with cloth.
a) Straps decorated with pure cotton are well conserved.
b) However, the wool parts of the others have been damaged by insects.

2. PRINCIPLES OF CONSERVATION TREATMENT

Five principles underlie the conservation treatment for fishing implements and articles for salt-making, as directed by the Traditional Culture Division of the Agency for Cultural Affairs.

(1) Selected decayed and corroded fishing implements with iron parts were desalinated and restored during the period 1974–1977. Since 1978 the policy has been to dismantle them as little as possible, to avoid damaging rivets and other parts;
(2) Wherever possible original parts are retained;
(3) Where required artifacts are restored;
(4) Surface dirt is removed but signs of use are not; and
(5) Rust that has expanded irregularly and peeled is removed. (In general, red and black rust is not removed, to avoid destruction of the metal parts and to respect the original shape.)

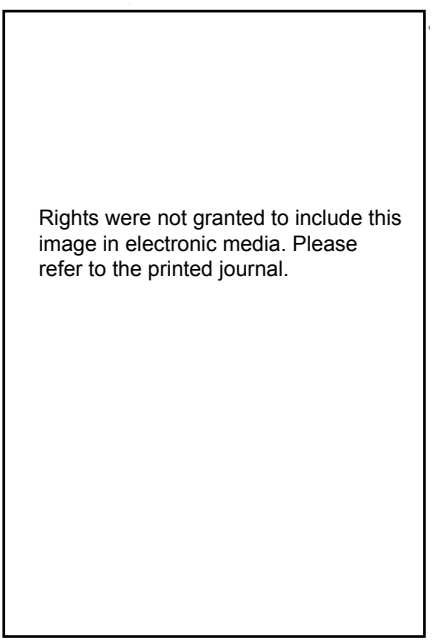
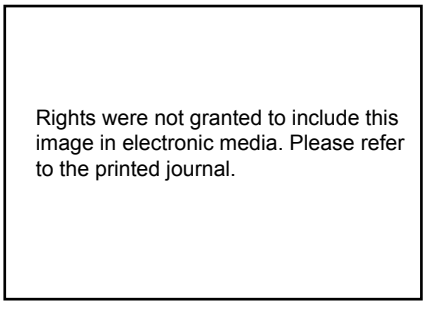


Fig. 2. Wooden tub. The staves have shrunk and become loose, and a hoop has slipped out. It is just about to collapse.

Fig. 3. An iron stamp for branding. The surface is completely corroded and partially scaled off.



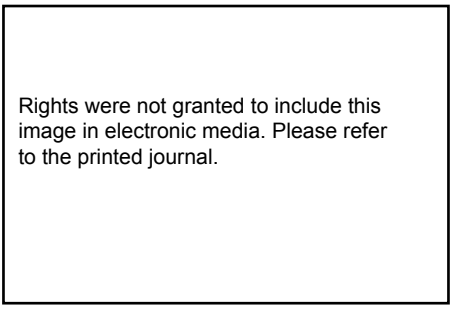


Fig. 4. a) Saddle for an ox.
b) Detail of the above. The jockey is made of rice straw, which has been consumed by insects and attacked by fungi, and has thus become brittle and gray. Iron parts are rusted and are spotted with heavy corrosion. The saddle is heavily covered with dust, as a result of having been left in the open air.

3. THE PROCESS OF CONSERVATION AND RESTORATION

There are 13 steps in the process of conservation and restoration used at the Gangoji Institute for Research of Cultural Properties (Fig. 5) [MASUZAWA 1985].

3.1 Survey and Examination

When instructed by the Agency for Cultural Affairs, staff members evaluate museum collections to select artifacts for conservation.

3.2 Packing and Transportation

When formally contracted, staff members pack and transport artifacts to the laboratory of the Gangoji Institute for Research of Cultural Properties. Each artifact is usually wrapped with thin paper and air-cushion polyethylene (PE) film, placed in a corrugated cardboard box, and transported by truck or train.

3.3 Checking, Recording and Proposals for Treatment

Each object is checked for shape, materials, method of fabrication, degree of rusting, and deterioration, and the details are recorded on cards. Photographs are also taken and, if required, the artifact X-rayed. Conservation treatment to be applied to each artifact is then decided on, and artifacts are classified according to treatment type.

3.4 Cleaning

Dust is usually removed from surfaces with a brush or small broom, and from cracks by using a bamboo cooking spit and needles. Dirt and stains are removed by sticking Japanese paper to the surface of the artifact, then soaking it with water (Fig. 6). The paper is then air-dried and peeled off. This removes an external layer of dirt and stains. This process is repeated as often as required. Trace of usage, such as the gloss left by hands on a hoe handle, or the fish scales that remain in a bamboo basket, are not removed.

Only rough red corrosion, sand and mud on the surfaces of iron parts are removed with bristle or wire brushes. However, if removal of rust would result in the loss of the original shape of an artifact it is not removed, regardless of the degree of the corrosion.

Implements already in fragments are placed in polyester silk screen bags or fabric bags, to prevent loss.

3.5 Dismantling

Materials are dismantled only when they can be taken apart easily and when no damage is likely to result. (Dismantled parts should be kept separately in three categories: iron, other metals and non-metallic.)

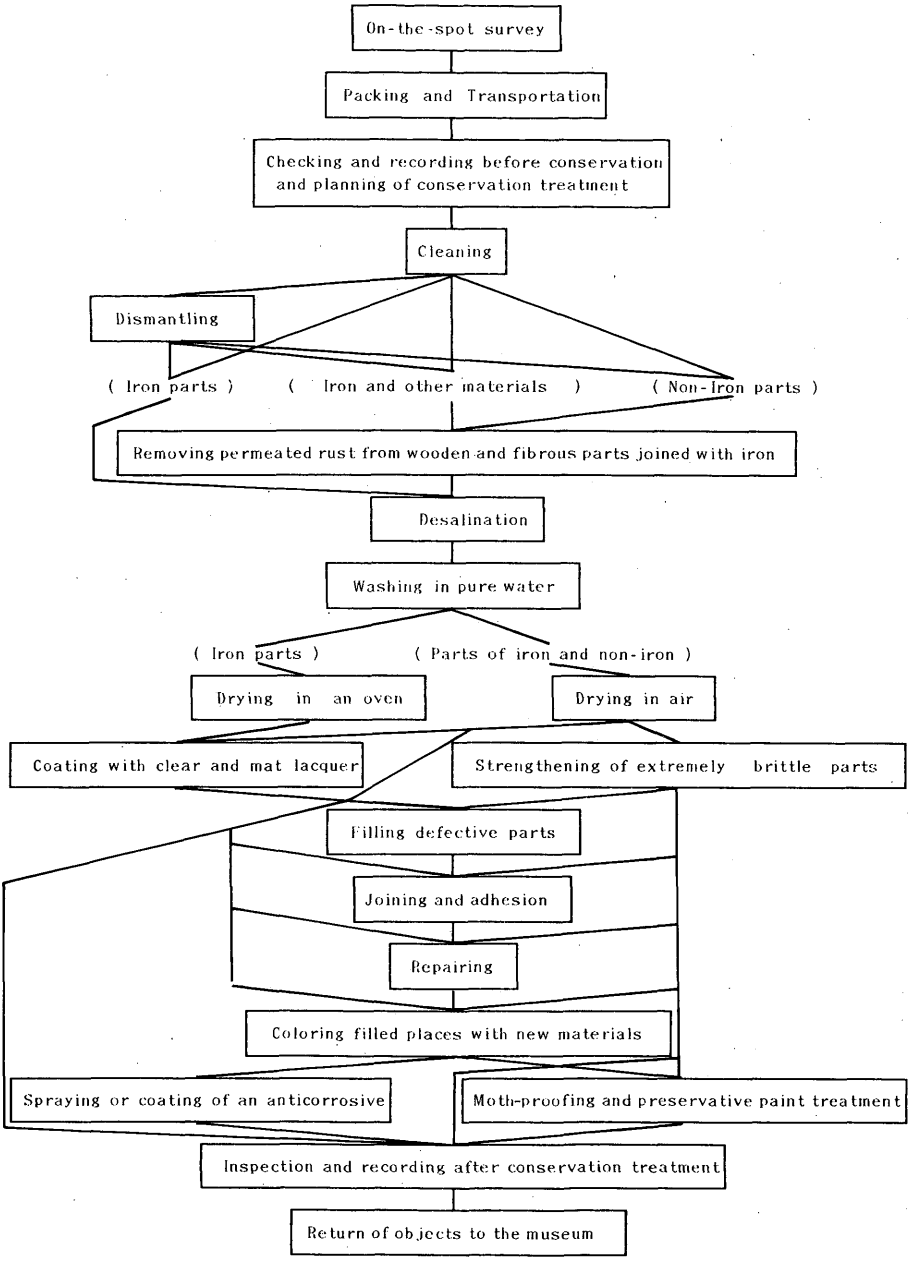


Fig. 5. The process of conservation and restoration of selected artifacts made of iron and other materials, and which are Important Tangible Folk Cultural Properties.

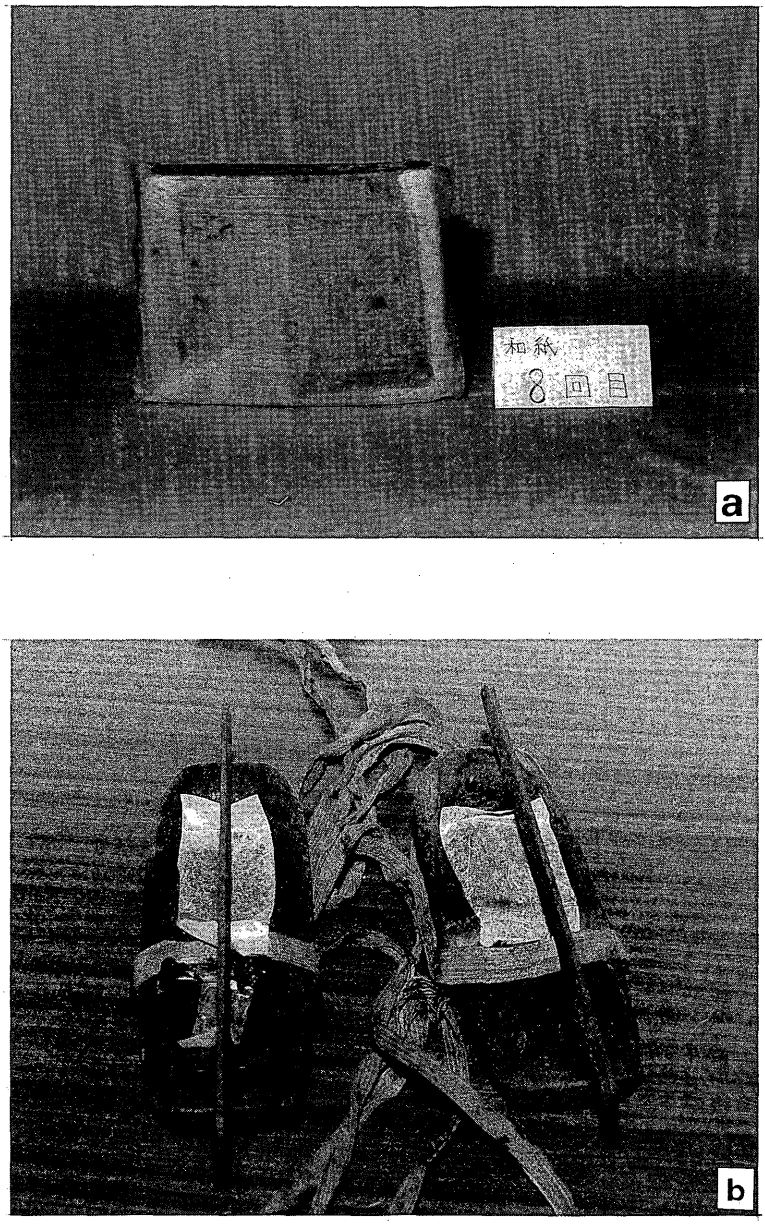


Fig. 6. Dust cleaning with Japanese paper.
a) Bamboo basket.
Wet paper is stuck on the surface, then dirt and stains are extracted by water and enter the paper.
b) Pair of skating clogs under the same treatment.

3.6 Removing Permeated Rust from Wooden and Fibrous Parts Joined with Iron

When ferrous iron adheres to and penetrates organic materials it changes to ferric compounds. This causes not only dirt and stains but also becomes a catalyst for decomposition. To remove the iron ion, the materials are therefore dipped in an aqueous solution of EDTA-2Na. Usually they are soaked in a 1% aqueous solution of EDTA-2Na for 2–3 days and then cleaned under running water. Corrosion that is difficult to remove is dissolved with oxalic acid, which is then removed under running water.

3.7 Desalination

Temporary tanks are made for desalinating each fishing implement (Fig. 7). A desalinating solution of 2% aqueous solution of sodium sesquicarbonate is used, based on previous experiences using 2%, 3%, and 5%, which resulted in few differences [UEDA, MATSUDA and DATE 1985]. The implements and their parts are immersed in the solution, and the concentration of released Cl^- ion measured using a micro-processor ion analyzer. (Micro-Processor Ion Analyzer 901, with Electrode 93-17 [Orion Research Co. Ltd.]. The range of measurement is 0.2–35,500 ppm.)

When the rate of Cl^- ion release has leveled out, the sodium sesquicarbonate solution is replaced by a new batch. After desalination, pure water is poured into the tanks and the sodium sesquicarbonate, which has penetrated into the artifact, is removed. This is continued until the water in the tanks attains pH 7.0 and 1–2 ppm of Cl^- ion. Accurate calibration of the electrode at pH 5.0 is required before each

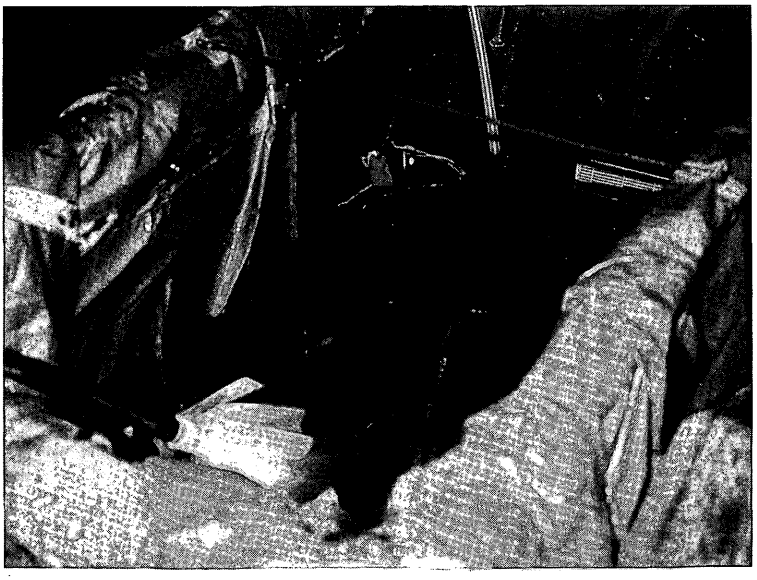


Fig. 7. Desalination in a temporary tank.

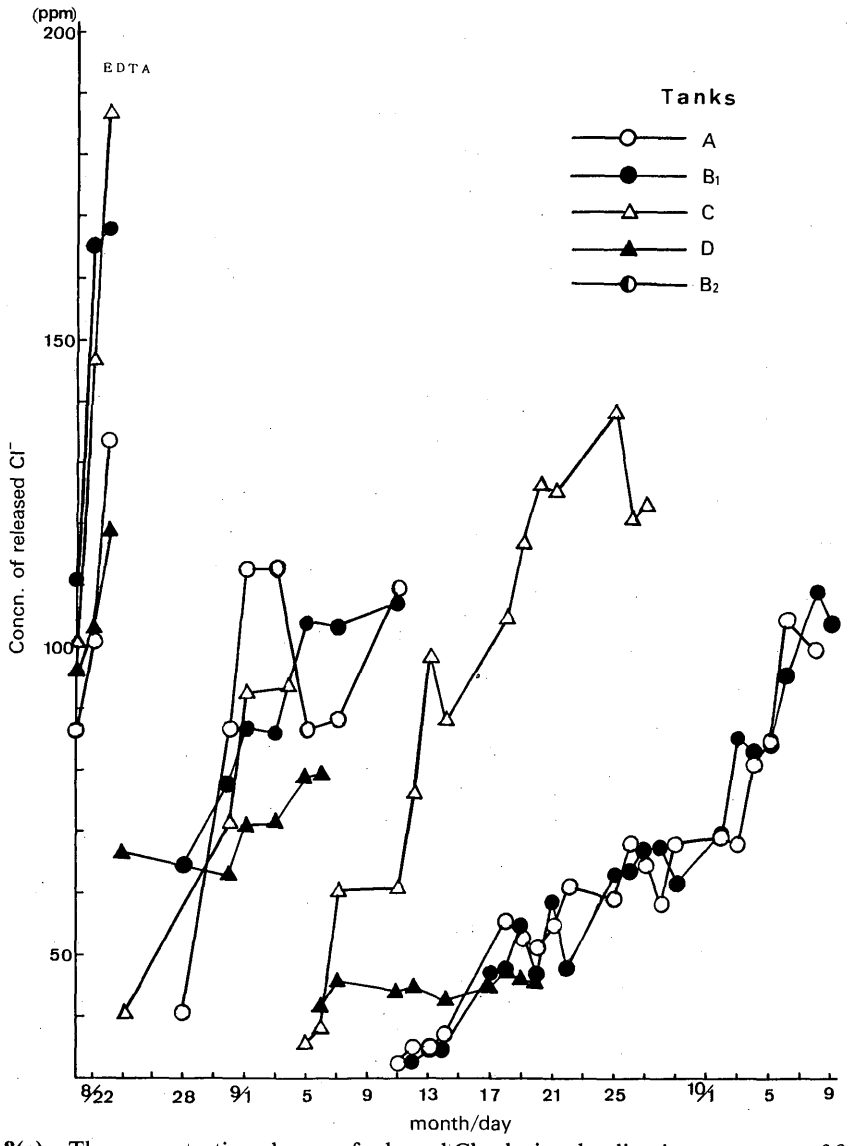


Fig. 8(a). The concentration change of released Cl^- during desalination treatment of fishing tools (1984).

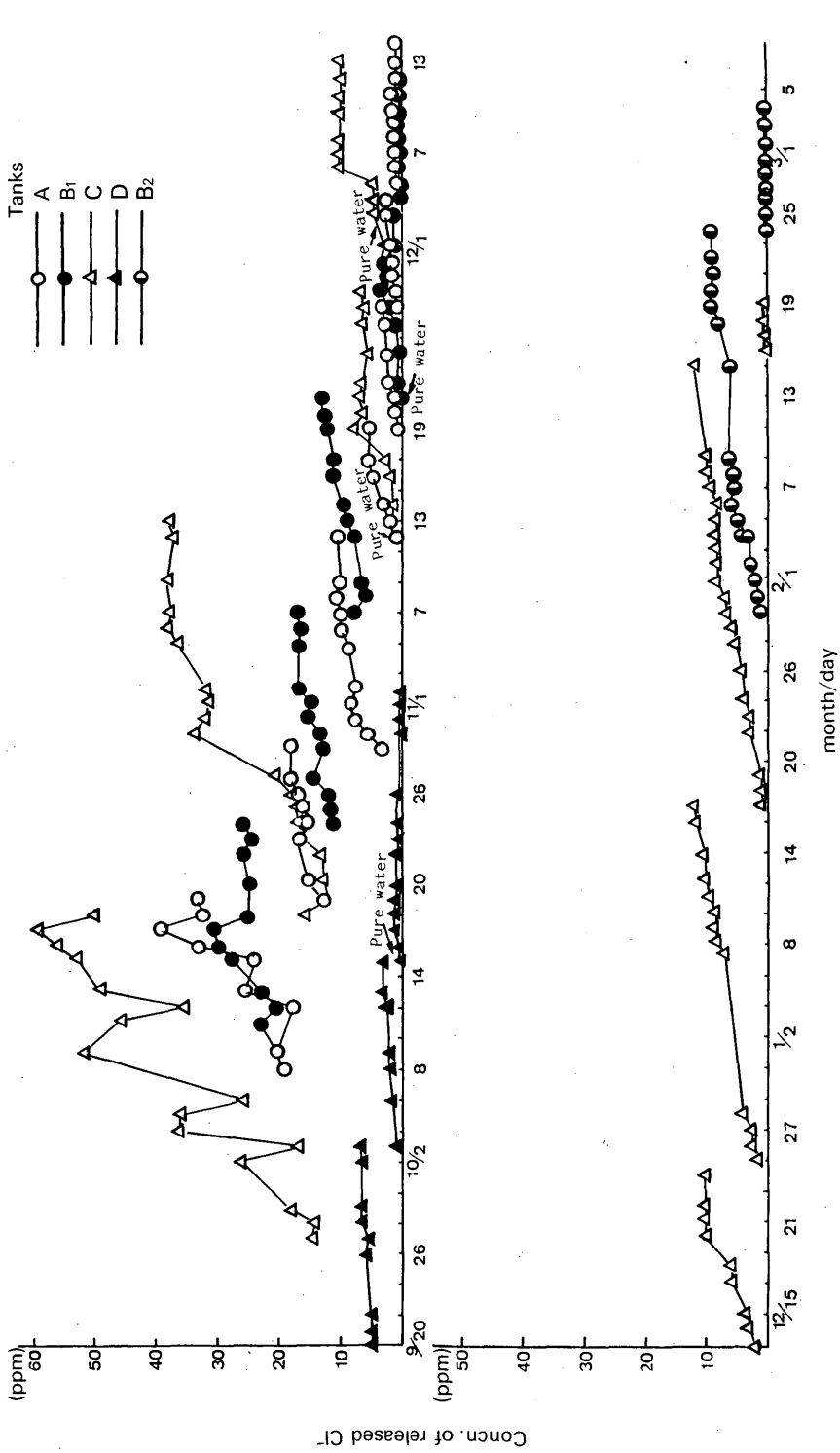


Fig. 8(b). The concentration change of released Cl^- during desalination treatment of fishing tools (continued) (1984–1985).

Table 1. Time spent in desalination.

Tank No.	Volume of soln. (m^3)	Principal Materials of Object	Concn. of chem. agent 1[1] (wt %)	Time for treatment (unit: days)				
				Permeated rust		Desalination		Total
				Soaking in chem.agt.2[2]	Cleaning in running water	Soaking in chem.agt.1[1]	Soaking in pure water	
A	1.8	Mainly wood & iron	2	2	5	76	32	115
B_1	2.7	Mainly wood	5	2	5	85	21	113
C	1.6	Wood & iron	2	2	5	97	81	181
D	1.1	Iron, wood, cotton fiber	5	2	1	52	18	73
B_2	2.7	Iron	3	—	—	25	7	32

*1 Chemical agent 1: aqueous solution of sesquicarbonate.
*2 Chemical agent 2: 1% aqueous solution of EDTA-2Na salt.

monitoring, to avoid possible intervention by interfering ions [UEDA, MATSUDA and DATE 1985], although it may be affected only little by dissolved Fe^{++}, Fe^{+++}, and Na^+ ions. Figs. 8-a and 8-b, and Table 1 show the concentration of Cl^- *versus* time spent in desalinating the fishing implements conserved and restored in 1984–1985.

3.8 Drying

After desalination iron implements and iron components are dried, either with an infrared dryer or in an oven. Implements, made of other materials are dried slowly, in air, at 60% RH.

3.9 Coating

Iron objects and the iron parts of objects are coated with two or three layers of a clear lacquer (Fig. 9). The lacquer consists (by weight) of acrylic resin (Paraloid B-44: Rohm and Haas Co. Ltd.) 20%, xylene 40%, and ethyl acetate 40%.

Iron surfaces are then coated with one or more additional layers of mat lacquer, which consists (by weight) of acrylic resin (Paraloid B-44) 20%, mat agent (silica powder) 5%, xylene 37%, and ethyl acetate 38%.

Iron surfaces must be coated carefully, using a thin brush. In particular, attention must be paid to the iron connecting parts between a tang, ring or knob and a wooden handle, or between a hoop and the strings of a landing net, for example. Alternatively, clear lacquer may be injected into cracks and slits, to protect against future rusting. "Pinholes" or "fish eyes" in the surface of the clear film is prevented by applying several thin coats of lacquer, rather than one thick application.

Acrylic emulsion clear lacquer is applied to surfaces where old paint film and coated tar remain. Were they treated with the organic solvent based clear lacquer, described above, they would swell or dissolve.

3.10 Spraying or Coating of an Anti-Corrosive Agent

It is extremely difficult to avoid defects in the lacquer film applied to corroded

Fig. 9. Coating on iron objects.

surfaces. Thus an anti-corrosive agent, in which the principal ingredient is paraffin wax, is sprayed or brushed on the artifact. Since the surface tension of the agent is very low, it is permeable enough to effectively correct any faults in the lacquer film coating.

3.11 Strengthening of Brittle Non-Ferrous Parts

Wooden objects and parts that have become extremely brittle through the actions of insects or fungi are impregnated with an acrylic solution (Paraloid B–44) under vacuum. Alternatively, they are soaked in it, and impregnated by immersion. After having been placed in a vacuum chamber, at 100 mm Hg/3 hours, objects are immersed in the acrylic solution for more than 1 hour. They are then dried in air, and the extra acrylic solution that has seeped into the surface is removed.

The solution of non-yellowing flexible urethane prepolymer (PSNY-10: Kotobuki Kako Co. Ltd.) is brushed over weakened vegetable fiber objects, until they are well impregnated. They are then dried in air. They become slightly hard, but tough, and are not easily broken by shock or tension.

3.12 Moth-Proofing and Preservative Paint Treatment

Wooden objects and parts are coated with an insecticide and an antiseptic, to prevent damage by insects and fungi. This treatment is done only when a slight change of color and a degree of toxicity are acceptable, and when artifacts are to be kept in the open. They are coated with polychloronaphthalene (Xylamon TH Clear), which has no gloss and does not stain.

When insects and fungi are present, however, they are fumigated with a mixture gas of methyl bromide (CH_3Br) and ethylene oxide (CH_2CH_2O), and the like.

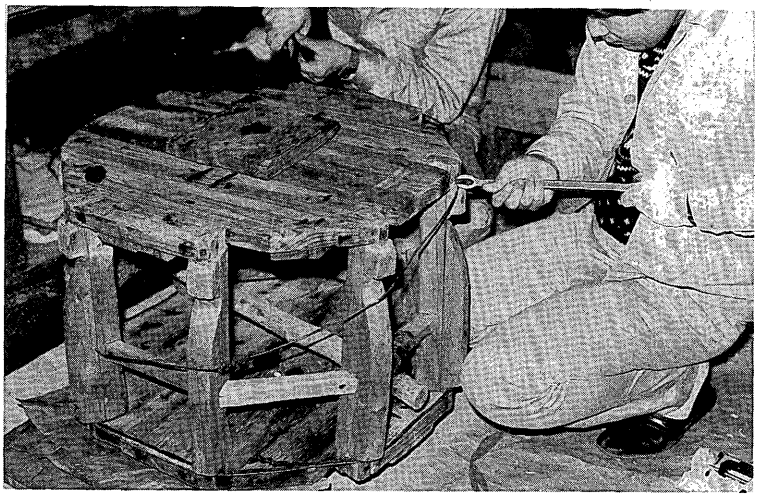


Fig. 10. Restoring a fishing net winder.

3.13 Restoration (Fig. 10)

Defective parts are restored only minimally, and only when the shapes and materials can be ascertained. Defective parts unrelated to the structure of an artifact are filled with epoxy resin (Araldite SV-426: Ciba-Geigy Co. Ltd.; or Cemedine Hi-Super: Cemedine Co. Ltd.) and micro-balloons of phenol resin or glass (Nippon Silica Co. Ltd.).

A glue of polyvinyl acetate emulsion (Wood Craft Bond: Konishi Co. Ltd.) is used for joining and adhesion. When needles and rivets are too rusty to connect parts, adhesive-covered bamboo plugs are used for joining, to distinguish old parts from new ones, and so as not to obscure the original parts of an artifact by its restoration.

Unraveled string and cord are re-twisted and tied, and a penetrating cyanoacrylate is added at one end. Frayed strings are tied at the end of the remaining twist. Broken ones are returned to their original position and fastened with a drop of cyanoacrylate. Traditional craftsmen are hired to repair holes in nets and the like.

Places filled with new materials are painted with butyral resin and pigments. Care is taken to avoid destroying the original natural appearance of the artifact by the use of new colors, adhesives and other materials.

3.14 Inspection and Recording after Conservation Treatment

After conservation treatment, the fishing implements are inspected individually. They are touched up if necessary. The methods used in their conservation and restoration, especially when any new parts or repairs have been made, are recorded on cards. The artifacts are photographed, both in general view and in detail.

Finally, a conservation and restoration report is prepared. Two copies are made. One is given to the museum and the other filed in the institute. Instructions for the correct storage of the artifact are written in an appendix to the report.

3.15 Return of Objects to the Museum

When the conservation and restoration process is completed the artifact is returned to the museum.

4. SEVERAL PROBLEMS IN CONSERVATION TREATMENT

The extremely rapid corrosion, deterioration and decay of iron and the other materials of folk materials led us to develop the conservation system described above. When the condition of treated and untreated artifacts is compared, the effectiveness of the system becomes immediately apparent. Several hundred folk materials have been treated with the above system in our institute since 1979. Figs. 11, 12 and 13 show three general cases. Fig. 11 shows the old conservation system. Despite there having been no complaints about any further corrosion in 5 years, there are, nevertheless, several problems in the system.

4.1 Anti-Corrosion Treatment

The first problem is that red rust has been allowed to remain on the metallic parts of the designated Important Tangible Cultural Properties. But in other cases undesignated artifacts are often cleaned and sharpened until their metal and black corrosion products appear, and then they are coated with oil or clear lacquer [KOBAYASHI and MINO 1978; MASUZAWA, YASUI and DATE 1982]. It still remains to be decided which is the better alternative.

Secondly, the problem of the corrosion of iron must be recognized, particularly at joints in a metal object, or when iron is buried under cloth or surrounded by string, for example.

The influence of desalination on parts made of materials other than iron is another problem that must be considered. In particular: (1) desalination using an aqueous solution of sodium sesquicarbonate is time-consuming; (2) sodium sesquicarbonate sometimes remains in wood, bamboo and fiber parts; (3) curved wooden objects may be distorted by use of the solution; and (4) desalination with sodium sesquicarbonate may discolor dyed textiles.

These problems must be checked for each material. Further research must be conducted to develop even more effective methods for conserving folk materials.

5. ACKNOWLEDGMENTS

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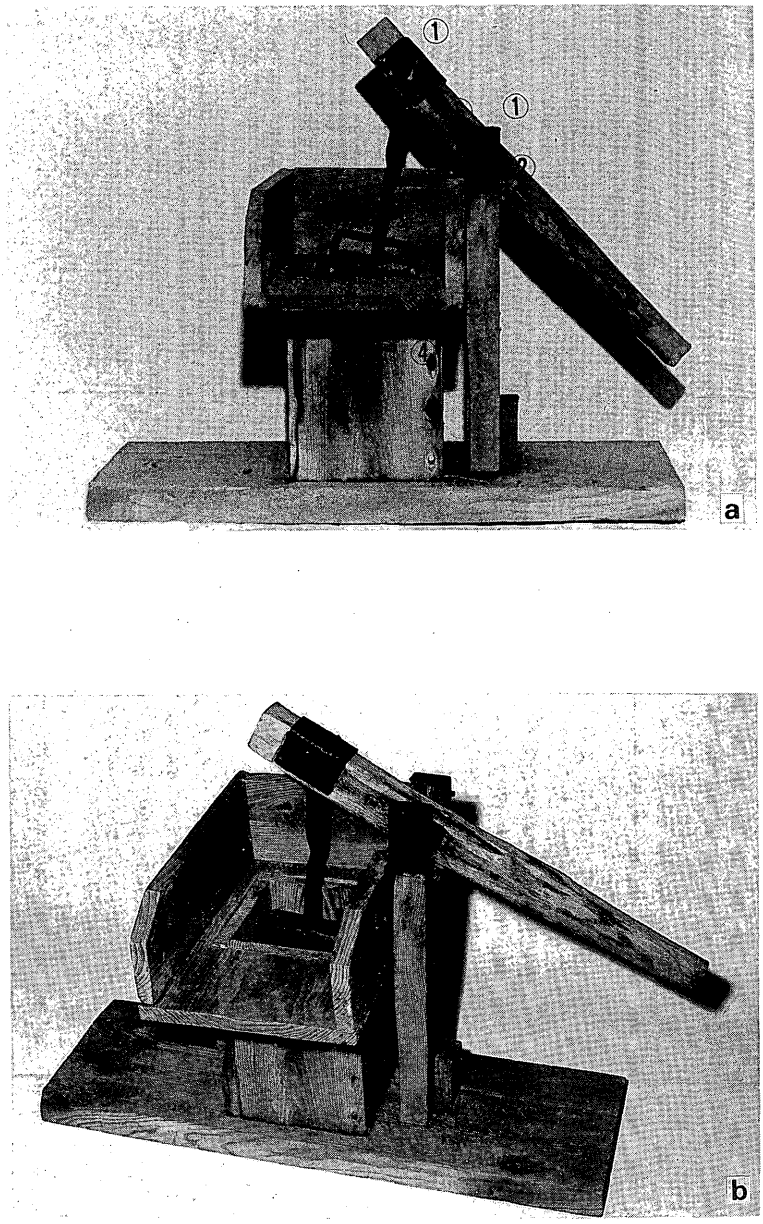

Fig. 11. A pump for salt-water suction (coll.: Akoh Municipal Salt Museum), treated in 1974–1975.

Note for Fig. 11.

a) *Before Treatment* (top)

① Iron plates covering the wooden handle were used as the bearings. The insides were heavily corroded and had cracked into several layers.

② The iron shaft had rusted and expanded, putting pressure on the wooden handle. The handle was split.

③ The iron arm of the piston; some component parts of it, one part of which was connected to the valve seat, had broken and was missing.

④ The cylinder was made of a pine plate. Beads of brown liquid were on the tops of nails. Crystallized salt was on the top of the lowest nail. These had stained the wooden cylinder.

⑤ The valve of the piston was made of leather inserted between the two iron plates. But they were cracked and decayed into fragments so that their original shapes could not be determined exactly.

⑥ Some parts of the wooden handle in contact with iron parts had deteriorated, being decayed by iron corrosion products.

b) *After Treatment* (bottom)

① Rust was removed. The iron parts with porous corrosion were penetrated with acrylic emulsion. Their insides were coated thickly with acrylic coating to separate them from the wooden parts. This was aimed at protecting them from water which was absorbed by the wood.

② The thick rust was removed. The crack was filled with epoxy resin and phenolic microballoons, and colored on the surface.

③ The missed part of the arm was reconstructed by a traditional smith by welding on a new part. It was artificially corroded to keep a similar appearance to the old original iron part.

④ It took 12 months to desalt the pump. Stains of corrosion were removed from the wooden parts with aqueous solution of EDTA-2Na salt.

⑤ X-ray radiography was applied to reveal the original shape and structure of the valve. The lost part was made of artificially corroded and coated iron plates and leather.

⑥ The missing and badly decayed parts were filled with paste of epoxy resin and microballoons, and painted on it.

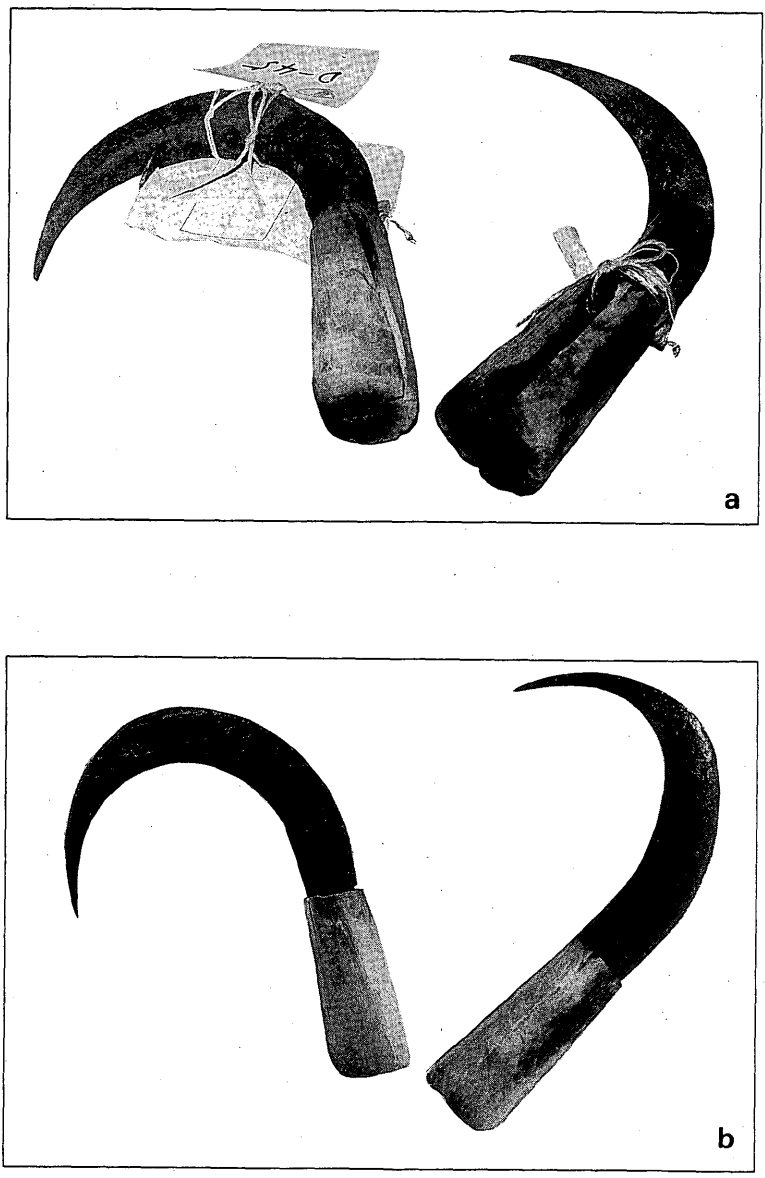

Fig. 12. *Tachigai no kagi* (shellfish rake, coll.: Seto Inland Sea Folk History Museum), treated in 1982–1983.
a) Before treatment (top)
b) After treatment (bottom)

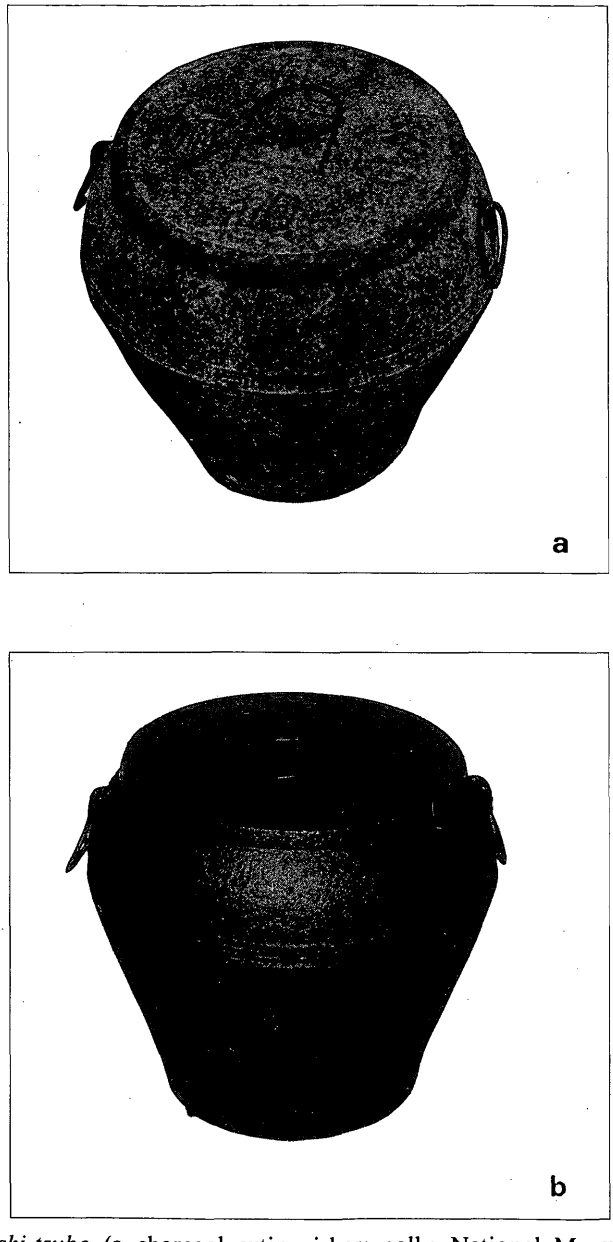

Fig. 13. *Hikeshi-tsubo* (a charcoal extinguisher; coll.: National Museum of Japanese History), treated in 1984–1985.
a) Before treatment (top)
b) After treatment (bottom)

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