

## (2) 文化財の安定化処理および修理

### 1) 岩手県指定文化財吉田家文書の安定化処理

#### 吉田家文書の救出

陸前高田市立図書館の貴重本庫に収蔵されていた岩手県指定文化財吉田家文書は、一関市博物館と陸前高田市教育委員会職員、および陸前高田古文書研究会員により2011(平成23)年3月31日に救出され、その日のうちに一関市博物館に搬送されました。一関市博物館で水道水による洗浄が施された後、同年4月3日に岩手県立博物館(以下、岩手県博)に運び入れられました。救出時表面に固着していたと思われる多量の土砂は洗い流されていましたが、小口や綴じ糸の周辺には微細な土砂が残っていて(図1)、腐臭が感じられました。

#### 安定化処理手順の構築

岩手県博には、吉田家文書とは別に2011年4月2日と3日の両日、岩手県教育委員会、陸前高田市教育委員会、県博職員らによって救出された吉田家文書関連資料、現在の陸前高田市を構成する合併前の町村議会関係資料等が搬入されました。まず、上記資料の中から水洗可能な資料を選別し、水損資料の修復報告(防府市教育委員会「版本大般若経」修復指導委員会事務局編 2011、坂本2010)、湿地帯から出土した文化財の保存処理方法、文化財科学の研究者や保存修復の専門家からの助言を基に安定化処理手順を構築し、

処理をしました。処理の過程で必要に応じ改良を加え、処理方法をより確実なものにしたうえで、吉田家文書の処理に取り掛かりました。

#### 吉田家文書の安定化処理

##### A. 洗浄

まず処理を施す古文書を肉眼観察し、処理前の状態を写真に記録しました。次に古文書を不織布で包み保護した後、水道水で半分程度満たしたトレーの中に入れ、刷毛や小型の筆を使って古文書表面に残っている土砂を取り除きました。

##### イ. 脱塩

古文書を取り出し、400ppm次亜塩素酸ナトリウム水溶液の中に15分程度浸漬し、資料に生息する真菌や細菌を殺菌しました。再び約13Lの水道水を入れたトレーの中に一昼夜浸漬し、古文書に含まれる塩分を溶出しました。24時間後、トレーの水道水を交換し、再度古文書を浸漬しました。脱塩液の塩化物イオン濃度が6ppm以下になるまで、この操作を5~6回繰り返しました。6ppm以下になったことが確認された段階で古文書を、水道水を入れた超音波洗浄機の中に入れ、15分間超音波洗浄しました。次に精製水を入れた超音波洗浄機でさらに15分間超音波洗浄処

## (2) Stabilization and Restoration of Cultural Assets

### 1) Stabilization of the Yoshida Family Documents, a Designated Cultural Property of Iwate Prefecture

#### Salvage of the Yoshida Family Documents

The Yoshida Family Documents are a designated cultural property of Iwate Prefecture. They had been stored in a warehouse for valuable books belonging to the Rikuzentakata City Library (hereinafter referred to as "RTCL") prior to the disaster. They were salvaged on March 31, 2011 by staff members of the Ichinoseki City Museum and Rikuzentakata City Board of Education, and members of the Rikuzentakata Old Documents Study Group. They were immediately transferred to the Ichinoseki City Museum on the same day. Following rinsing with tap water at the Ichinoseki City Museum, the documents were brought to the IPMM on April 3, 2011. The large amount of dirt and sand that most likely affixed to the surface of the documents while they were being salvaged was almost completely removed. However, minute dirt and sand particles attached to the binding thread and the three open sides of the documents (Fig. 1). There was also a putrid odor emanating from the documents.

#### Development of the stabilization procedure

In addition to the Yoshida Family Documents, objects related to the Yoshida Family Documents and objects related to town or village assemblies of the pre-merger municipalities which now form the current Rikuzentakata City were salvaged by staff members of the Boards of Education of Iwate Prefecture, Rikuzentakata City and the IPMM were brought to the IPMM on April 2 and 3, 2011. Washable items were selected from the salvaged assets, and a stabilization procedure was developed

for the salvaged items based on water-damaged objects restoration reports (Hofu City Board of Education Woodblock-Printed *Great Perfection of Wisdom Sutra* Repair Supervisory Committee Office (Ed.) 2011, Sakamoto 2010), preservation methods of cultural assets excavated from wetlands, and advice from preservation/restoration experts and researchers in the field of scientific studies on cultural assets. Using these procedures and making modifications when necessary, the objects related to the Yoshida Family Documents were treated first. After evaluating the effectiveness of this treatment, we engaged in the stabilization treatment of the Yoshida Family Documents.

#### Stabilization of Yoshida Family Documents

##### A) Washing

Prior to treating the old documents, they were observed and their pre-treatment condition was photographed. Then, after protecting the document by covering it with nonwoven fabric, it was placed into a tray approximately half full of tap water, and the dirt and sand particles remaining on the surface of the documents were removed using large and small brushes.

##### B) Desalination

After removing the documents from the tap water tray, they were immersed in a sodium hypochlorite aqueous solution with a concentration of 400 ppm for approximately 15 minutes to disinfect the fungi and bacteria on the documents. Then the documents were once again immersed in a tray filled with 13 L of tap water for a whole day and night to elute the salt contained in the documents. After 24 hours, the tap water in the

理しました。一連の処理によって、古文書内部に残っている細かな土砂が取り除かれました。精製水を使用した超音波洗浄機の処理では、古文書の塩化物イオン濃度を1ppm未満に低減することができました。

tray was exchanged and the documents were immersed again. This process was repeated 5 or 6 times until the concentration of the chloride ions contained in the desalination liquid reached 6 ppm or less. After confirming that the liquid in the tray had reached 6 ppm or less, the documents were placed in an ultrasonic cleaner filled with tap water and treated for 15 minutes. Then, the documents were placed in the ultrasonic cleaner for another 15 minutes using purified water. Using this series of treatments, the minute dirt and sand particles that had affixed to the documents were removed. Furthermore, we were able to reduce the salinity of the documents to 1 ppm or less by a process of ultrasonic cleaning using purified water.



1. 写真撮影  
1. Photography



2. 不織布による保護  
2. Protection with non-woven fabric



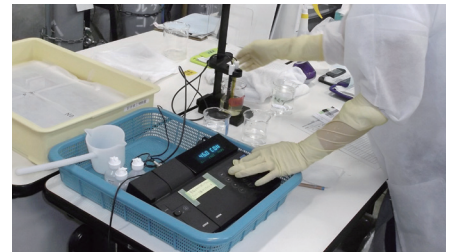
3. 水道水による洗浄  
3. Rinsing with tap water



4. 次亜塩素酸ナトリウム水溶液（400ppm）による殺菌洗浄  
4. Cleaning and sterilization using a sodium hypochlorite aqueous solution with a concentration of 400 ppm



5. 水道水による脱塩処理  
5. Desalination using tap water



6. 脱塩液に含まれる塩化物イオン濃度の測定  
6. Measurement of the chloride ion concentration contained in the desalination liquid



7. 水道水による超音波洗浄  
8. 精製水による超音波洗浄  
7. Ultrasonic cleaning using tap water  
8. Ultrasonic cleaning using purified water



9. 加圧による水分除去  
9. Water removal using additional pressure



10. 自然乾燥（一部の水分除去）  
10. Natural air drying (partial drying of the asset)

図1 吉田家文書の安定化処理工程

Fig. 1 Stabilization procedures for the Yoshida Family Documents



## ウ. 真空凍結乾燥

超音波洗浄機から取り出した古文書をアルミの板で挟み、加圧して水分を除去した後、不織布を取り外し、風通しの良い場所で2～3日自然乾燥しました。ある程度水分除去して乾かした後、古文書を可能な限り開いて料紙の状態を目視観察し、耐油紙で作った短冊状の紙を点検した箇所には挟み込みました。点検終了後古文書を耐油紙、次に不織布で包み込んだ後、冷凍庫に入れ凍結しました。耐油紙で作った短冊状の紙は、料紙と料紙の間にわずかな隙間を確保し、乾燥の効率を高めると共に、真空凍結乾燥の過程でしばしば生じる古文書の著しい変形を防ぐために施した措置です。現在古文書の凍結は冷凍庫で行っていますが、震災当初岩手県博に冷凍庫が整備される前は、ドライアイスを使って凍結しました。

凍結した古文書を真空凍結乾燥機に入れ、強制乾燥しました。この方法では液体を経ることなく水分を除去することができるため、古文書の形状変化を抑制することができます。

## エ. 消毒・点検

乾燥が終了した古文書を真空凍結乾燥器から取り出し、滅菌機に移しました。酸化プロピレンを使用し、約1週間費やしてくん蒸しました。くん蒸終了後、資料を点検し、同時に刷毛を使って綴じ糸周辺に残っている微細な土砂を除去しました。

## C) Vacuum freeze drying

After removing the documents from the ultrasonic cleaner, aluminum plates were placed on both sides of the documents to remove water using additional pressure. Then, the nonwoven fabric was removed, and the documents were dried naturally for two to three days in a well-ventilated location. After drying and removing a considerable amount of the water from the documents, all the pages that could be opened were spread apart. Then, the condition of the opened pages was observed, and a strip of oil-proof paper was placed between the examined pages. Following this examination, the documents were wrapped in oil-proof paper and then in a nonwoven fabric, and were frozen. The paper strips made of oil proof paper ensured that a slight space existed between the pages which enabled more efficient vacuum freeze drying. Inserting the paper strips also prevented deformation of the document surface which is a frequently occurring problem observed during the vacuum freeze drying process. While we are currently using a freezer for freezing old documents, we had been freezing them using dry ice following the earthquake until a suitable freezer was installed at the IPMM.

The frozen documents were placed in a vacuum freeze dryer to thoroughly dry them. This treatment prevented deformation of the documents and enabled efficient drying because water was removed without passing through a liquid state.

## D) Sterilization and inspection

The completely dried documents were removed from the vacuum freeze dryer and placed in a sterilizer. The documents were fumigated for approximately 48 hours using propylene oxide. Following the fumigation process, the documents were examined, and the residual minute dirt and sand particles around the binding thread was removed using a large brush.

## オ. 応急修理

点検過程で軽微な破損や剥離が確認された場合、放置しておくで破損部位の拡大や剥離した紙片の紛失が生じます。そこで古糊を使い、応急修理が可能な部位について修復しました。また、点検の過程で確認されたものの、剥離箇所を特定することが困難な紙片については、透明なチャック付ポリ袋に入れ保管しました。

## カ. 学術情報の保全

海水損古文書の安定化処理法は未確立です。一連の措置を施した古文書に今後どのような変化が起こるか全く予測がつかません。そこで、吉田家文書およびその関連資料については、安定化処理終了後デジタル画像を作成し、残された文字情報を保全することにしました。

当初撮像は解体をせずに実施する予定でしたが、安定化処理終了後、国立国会図書館において欠損部の補填を含む修復をしていただくことになったため、安定化処理終了後の外観を撮影した後、綴紐を解き、袋綴を開いて撮像しました。撮像が終了した古文書を薄葉紙で梱包し、中性紙文書箱に収納した後、撮像データと共に国立国会図書館に運びました。これまでに説明した安定化処理手順は図1に示すとおりです。

赤沼英男（岩手県立博物館）

## E) Emergency repair

When partial damage or detachment is confirmed during the examination process but left untreated, the damaged areas may enlarge or the detached paper fragments may be lost on occasion. Therefore, though limited to the parts where emergency repair could be performed, a flour-based aged glue called *furunori* was used to restore those treatable parts. Detached paper fragments, which were found during the examination process, but if the location they detached from could not be identified, they were stored by placing them in clear plastic bags that could be sealed shut.

## F) Preservation of scientific information

Stabilization methods for seawater-damaged old documents have not been established yet. It is impossible to predict what types of changes will occur to these documents stabilized by the above described series of treatment. Thus, we decided to record and preserve the written information of the Yoshida Family Documents and related objects by creating digital images of them following stabilization.

Our original intention was to photograph digital images without disassembling the old documents. However, since it was decided that the National Diet Library would restore the documents, including supplementation for lost material following the completion of the stabilization, after photographing the exterior of the post-stabilization documents, we removed the binding thread, opened the double-leaved pages, and photographed each page. After wrapping the photographed documents with soft thin paper and then placing them in a manuscript storage box made of acid-free paper, we delivered the documents together with the photographs to the National Diet Library. The stabilization procedure described is presented in Fig. 1.

Hideo Akanuma (Iwate Prefectural Museum)



11. 自然乾燥した資料の点検  
11. Examination of a document dried naturally



12. 耐油紙および不織布による保護  
12. Protection with oil proof paper and nonwoven fabric



13. 予備凍結  
13. Preliminary freezing



14. 真空凍結乾燥  
14. Vacuum freeze drying



15. 資料消毒（滅菌機によるくん蒸）  
15. Document sterilization (fumigation by sterilizer)



16. くん蒸した資料の点検  
16. Examination of fumigated documents



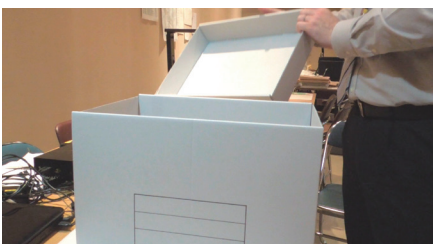
17. 剥離部の応急修理  
17. Emergency repair of detached portions



18. 古文書のデジタル化  
18. Digitalization of old documents



19. 中性紙箱への保管  
19. Storage in a box made from acid-free paper



20. 経過観察  
20. Follow-up observation

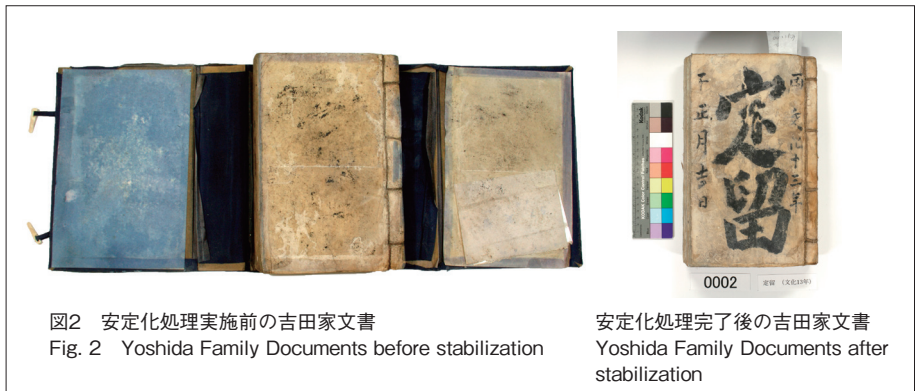


図2 安定化処理実施前の吉田家文書  
Fig. 2 Yoshida Family Documents before stabilization

安定化処理完了後の吉田家文書  
Yoshida Family Documents after stabilization

図1 吉田家文書の安定化処理工程（続き）  
Fig. 1 Stabilization procedures for the Yoshida Family Documents (Continued)