

《特稿》<sup>1</sup>

日本博物館災害防制措施：  
汲取於阪神・淡路大地震、  
東日本大地震及大海嘯的經驗教訓<sup>2</sup>

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Disaster Preparedness Measures at Japanese Museums:  
Building on the Lessons of the Great Hanshin-Awaji  
Earthquake, Great East Japan Earthquake and Ensuing Giant  
Tsunami

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<sup>1</sup> 編按：本文初稿乃作者於 2012 年 11 月 25-29 日國際博物館管理委員會澳洲雪梨年會演講內容，經本刊編輯室徵其意願並由作者改寫後，特以本期專題「特稿」刊載，以饗讀者。

<sup>2</sup> 本文得以完成，作者在此感謝以下單位及人士的慷慨協助：全國美術館會議，兵庫縣立美術館，神戶市立博物館，Emba 中国近代美術館，陸前高田市立博物館暨館長本多文人與主任学芸員熊谷賢，岩手縣立美術館暨首席專門学芸員大野正勝，宮城縣立美術館暨学芸部長三上滿良，石卷文化中心暨課長補佐佐々木淳，Takiya 株式会社。(Thanks to kind cooperation: The Japanese Council of Art Museums, The Hyogo Pref. Museums of Art, The Kobe City Museum, The Emba Museum of Chinese Art, The Rikuzentakada Municipal Museum, Director Humito Honda & Curator Masaru Kumagaya of The Rikuzentakada Municipal Museum, The Iwate Museum of Art & Chief Curator Masakatsu Ono, The Miyagi Pref. Museum of Art & Chief Curator Mitsuro Mikami, The Ishinomaki Cultural Center & Section Manager Dr. Atsushi Sasaki, Takiya Co. Ltd.)

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## Introduction

My mother's home and my family home are in Kobe, and both houses and their inhabitants experienced the Great Hanshin-Awaji Earthquake that struck the city in 1995. At the time I was working at an art museum in Shizuoka 400 kilometers away, and as the transportation network was disrupted, I spent 28 hours traveling back to Kobe by car. Thankfully, my mother and other family members were unhurt.

The following day (the third day after the quake struck), I entered the city of Kobe and saw what looked like the aftermath of a war, with smoke rising from countless fires, and over a hundred beds in the streets which had been brought out of hospitals deemed to be structurally unsound, with doctors and nurses milling around. The city of Kobe had failed to foresee that an earthquake of this severity might occur, and had fairly weak earthquake countermeasures in place at the time. As they had not placed quake-resistant rubber bases under the tanks that held water for firefighting, the earthquake had caused all the water to leak out and there was no way to fight the fires.

As a matter of fact, at that time in Japan experts considered Shizuoka a zone of high seismic risk, and the Shizuoka Prefectural Museum of Art had established a quake countermeasures team of which I was the leader. While we had considered steps to protect the exhibition rooms, we hadn't thought at all about measures to safeguard the storage areas. After the Great Hanshin-Awaji Earthquake it became clear that the region's museums had not implemented sufficient countermeasures for their exhibition rooms, let alone the storage areas.

In this paper I will discuss my observations, informed by these experiences, of Japanese museums' earthquake countermeasures adopted in the aftermath of the Great Hanshin-Awaji Earthquake, and examine these countermeasures in the

light of damage suffered by museums during the catastrophic earthquake that struck eastern Japan in March 2011.

## **Lessons of the Great Hanshin-Awaji Earthquake**

At 5:46 AM on January 17, 1995, the Great Hanshin-Awaji Earthquake struck Kobe, nearby Osaka and the island of Awaji with a magnitude of 7.2, and dealt a shock to the museum world as well. Basic utilities like electricity, gas and water were cut off, 6,434 people died, and 100,000 buildings were completely destroyed. At the time it was the worst earthquake to strike an urban area in Japan since before World War II. It also caused enormous damage to the many museums in the region, and this was a wake-up call to the museum community throughout Japan, as museum administrators became aware of the very real threat to their own institutions that natural disasters posed. It provided the impetus for a great many museums throughout the country to strengthen their seismic countermeasures.

Museums in Kobe and Osaka had been taking few if any steps to prepare for a possible earthquake. This is because nobody, with the possible exception of seismologists, had predicted that a major earthquake might strike the region. Of course all were aware that Japan is an earthquake-prone country, and it was second nature for curators to take measures such as securing ceramics and other fragile items with sturdy fishing line pulled into a cross formation, and placing sandbags in the pedestals of sculptures to lower the center of gravity and lessen the risk of tipping over. However, against this massive earthquake these measures were utterly ineffective, and a huge number of pieces tipped over or fell to the floor. Curators and museum staff across Japan were dumbfounded by the extent of the damage.

## Damage to Museums in the Region Affected by the Earthquake

### I. The Hyogo Prefectural Museum of Modern Art

#### i. Building

The building itself was heavily damaged. The museum had been built in 1970 primarily as a venue for exhibiting sculpture, and the ground-floor gallery was constructed to let in large amounts of natural light and maximize the skeleton were positioned outside the gallery, and there were only slender columns inside

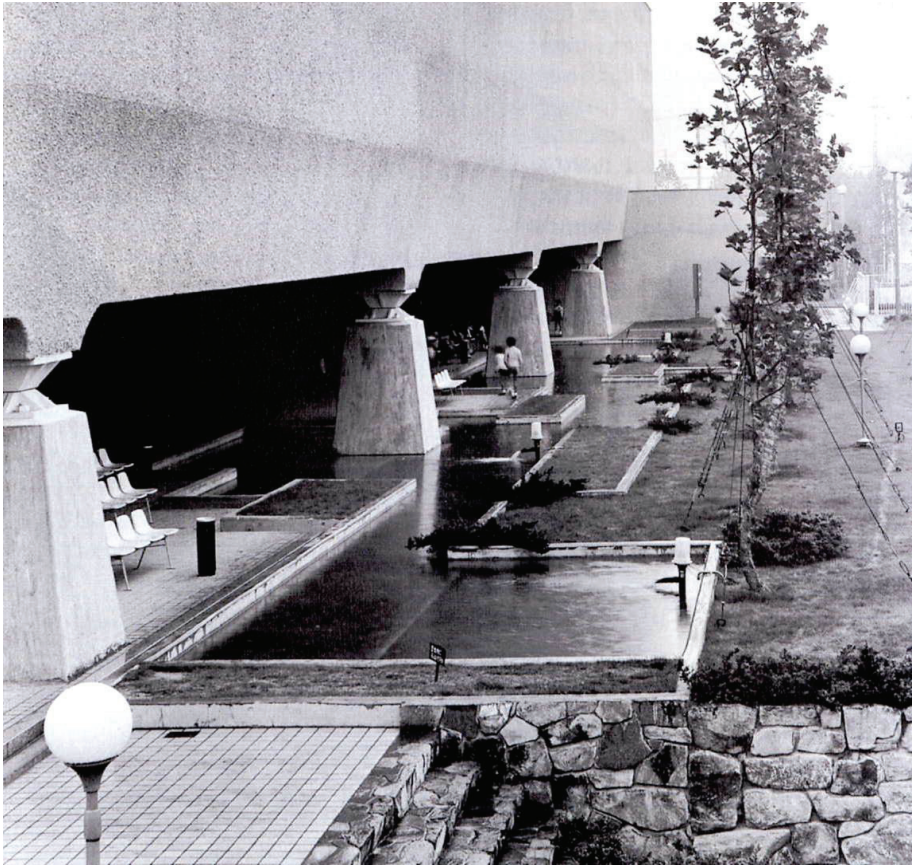


Fig 1. Thick columns in outside gallery, The Hyogo Prefectural Museum of Modern Art  
(Copyright: The Hyogo Prefectural Museum of Modern Art )

the gallery. This gallery measured 1,000 square meters and had glass walls on either side, with another 800-square-meter gallery on the second floor that contained no columns at all. Due to this design, the roof practically caved in and there was severe damage to the glass.

Also, as the museum had been built on an incline, it was structured so that some water pipes passed above the storage area, and in some parts water leaked from the ceiling. This is a point that ought to be taken into account in the architectural design of future museums.

ii. Galleries

In the galleries, sculptures tipped over and paintings fell from the walls.

iii. Storage areas

Sculptures in the storage area tipped over as well. (All of these works were



Fig. 2 Slender columns inside the ground-floor gallery, The Hyogo Prefectural Museum of Modern Art (Copyright: The Hyogo Prefectural Museum of Modern Art)

successfully restored within a few years, with marble dust used to restore the marble pieces.)

The greatest danger was posed by flat-file cabinets in the storage area. In Japan, many prints, maps and other works on paper are kept in flat-file cabinets. During the quake, however, the majority of the cabinets had their drawers jump out, and the resulting weight imbalance caused some to tip over.



Fig. 3 Exhibition room on the ground floor, The Hyogo Prefectural Museum of Modern Art (Copyright: The Hyogo Prefectural Museum of Modern Art from “Report of Investigation for Museums in the Great Hanshin-Awaji Earthquake I / II”)

## II. The Kobe City Museum

### i. Building

The Kobe City Museum building tilted westward at a five-degree angle, and a crack ran up to the third floor at the place where the main building was joined to the new wing. Water also flooded the basement nearly to the ceiling.

However, there was no major damage to the building. The five-degree tilt was corrected, repairs were made, and the museum continues operating to this day. This is evidence that the building, dating back to 1930, was designed to be structurally sound.

### ii. Galleries

Many display cases, weighing approximately one ton each, shifted by about a meter, and it's likely that this would have injured museum visitors if it had happened during museum hours. Some sculptures, despite supposedly effective preventive measures having been taken to prevent earthquake damage, had the



Fig. 4 The building tilted westward at a 5-degree angle, The Kobe City Museum (Copyright: The Kobe City Museum from “Report of Investigation for Museums in the Great Hanshin-Awaji Earthquake I / II”)

steel bars holding them in place ripped out. Sculptures tipped over, and there was damage to bronze works.

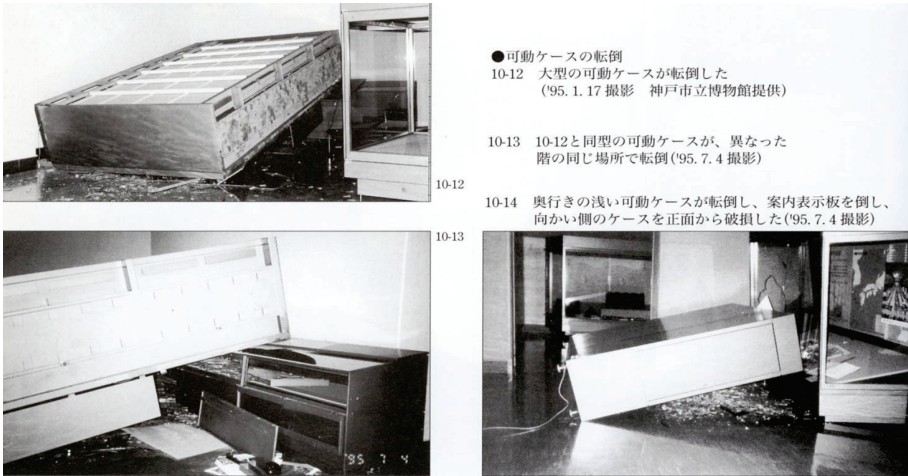


Fig. 5 Display cases moved in exhibition room, The Kobe City Museum (Copyright: The Kobe City Museum from “Report of Investigation for Museums in the Great Hanshin-Awaji Earthquake I / II”)



Fig. 6 Storage room, The Kobe City Museum (Copyright: The Kobe City Museum from “Report of Investigation for Museums in the Great Hanshin-Awaji Earthquake I / II”)



### iii. Storage area

Shelves in the storage area tilted drastically. Despite predictions that the art in storage would be severely damaged, those stored in the traditional Japanese manner prevalent since the Edo Period (1603-1868), in inner boxes housed in outer boxes made of Paulownia wood, were completely unharmed. This prompted a reassessment of this traditional storage method and renewed recognition of its efficacy. Naturally, items such as dishes that were simply placed on storage shelves broke when the shelves tilted over.

### **III. The Emba Museum of Chinese Modern Art**

Most of the Chinese ceramics in storage were damaged.

### **IV. Notable “Art Rescue” projects carried out in the aftermath of the Great Hanshin-Awaji Earthquake**

The system known in Japan as “Art Rescue” was first put into effect after the Great Hanshin-Awaji Earthquake. The Japanese Council of Art Museums, an organization that promotes information exchange and partnership among major Japanese museums, dispatched staff from the Bridgestone Museum in Tokyo where the Council was headquartered at the time, along with volunteer restoration specialists and people affiliated with the National Research Institute for Cultural Properties, Tokyo. About a week after the quake they arrived in Kobe, and solicited volunteer curators from damaged museums and other nearby museums to gather art and artifacts from temples and private homes in the Kobe and Osaka region. Their unflinching efforts succeeded in transporting these objects to safe locations.

The methodologies of Art Rescue were further honed during the response to

the magnitude 6.8 earthquake that struck the Niigata region on October 23, 2004. In the wake of the 2011 Great East Japan Earthquake, the Japanese Council of Art Museums and the national Cultural Affairs Agency were able to act swiftly, and a firm foundation was in place allowing Japan's national museums and other museums throughout the country to provide support where it was needed.



Fig. 7 Storage room, The Emba Museum of Chinese Modern Art (Copyright: The Emba Museum of Chinese Modern Art from “Report of Investigation for Museums in the Great Hanshin-Awaji Earthquake I/II”)

In addition, scholars and museum insiders who dealt with historical materials formed a volunteer organization for the conservation of documents affected by the earthquake, the Network for Historical Materials. The organization is active to this day, and continues to provide indispensable assistance to museums damaged in earthquakes or other disasters.

## **V. Lessons learned and policy guidelines adopted after the Great Hanshin-Awaji Earthquake**

- i. After a disaster, the rescue of survivors takes top priority.
- ii. If a disaster strikes during museum hours, the safe evacuation of museum visitors takes top priority.
- iii. Next, verify the safety of museum personnel.
- iv. Verify the status of damaged works of art. Take photos and gather data.
- v. Move artworks to a storage area or another safe location to guard against aftershocks, etc. (Important works from the Hyogo Prefectural Museum of Modern Art were temporarily stored at the National Museum of Modern Art, Kyoto.)
- vi. Construct safer museum buildings.

The Hyogo Prefectural Museum constructed a new, seismically resistant building and moved there seven years after the quake.

- vii. Use seismically isolated quake-resistant bases for important 3 D pieces. Install quake-resistant bases under display cases as well.
- viii. Employ hardware that prevents exhibits from falling.
- ix. Employ special glue that prevents ceramics, etc. from slipping.

- x. Install anti-tipping mechanisms in storage areas.
- xi. Take steps to prevent flat-file cabinet drawers from popping out.
- xii. Take measures to stop things from falling from the ceiling.

### **The Great East Japan Earthquake (Off the Pacific Coast of the Tohoku Region)**

At 2:46 PM on March 11, 2011, an earthquake struck, with its seismic center under the sea 130 kilometers off the coast of eastern Japan. The focal region (the area in which movements along fault lines occurred) was the largest ever recorded in Japan at approximately 100,000 square kilometers, extending about 500 kilometers north to south and 200 kilometers east to west. Its magnitude was measured at 9.0 and its seismic intensity at up to 7 in parts of



Fig. 8 The new building of The Hyogo Prefectural Museum of Art with Seismic Isolated Structure by Tadao Ando (Copyright: The Hyogo Prefectural Museum of Art)

Miyagi Prefecture and over 6 in many areas. Worst of all, it unleashed a massive tsunami that wreaked utter devastation on a long stretch of the Pacific coast.

When this tidal wave hit the Pacific coast in Japan's Tohoku and northern Kanto regions, it was over 10 meters high in most areas, and it reached 40.1 meters above sea level at its highest point. The ocean's fury obliterated everything in its path. It also caused the phenomenon of ground liquefaction in many areas, broke dams, and triggered the meltdown of nuclear reactors at the Fukushima Dai-ichi Nuclear Power Plant, which resulted in a large-scale radioactive leak. The disaster left approximately 19,000 dead or missing, and completely destroyed or half-destroyed 390,000 buildings.

In this paper, I will not explore the issue of the Fukushima nuclear power plant catastrophe, as I believe this matter requires an in-depth discussion that ranges far beyond the museum-related issues that concern us here.

Also, it is not possible to cover every damaged museum, as there are a great number of museums in the affected region that were damaged to some degree. For this reason, I will confine my report to a few specific museums. The Rikuzentakata Municipal Museum and Ishinomaki Cultural Center were among the most severely damaged by the massive tsunami. On the other hand, the Miyagi Museum of Art succeeded in minimizing the damage and served as a disaster-relief center for their region. Meanwhile, the Art Rescue network played a central role in coordinating support that poured in from throughout Japan.

## **I. The Rikuzentakata Municipal Museum**

The tsunami had crested to a height of 16 meters by the time it reached the museum 800 meters inland. All six of the employees on hand, including the museum director, lost their lives. (In a city of about 24,000 people, over 1,500 died and more than 300 went missing, among them about 100 city employees,

and municipal administration was paralyzed.)

One museum employee survived, a curator in charge of seashells, but at the time assisting evacuees took first priority, and the salvaging of museum exhibits did not begin until late April. Most of them had washed away, and what remained (specimens, ethnological artifacts and documents, etc.) was mixed with a mountain of debris. It was necessary to find a trained eye to tell them apart. The ledgers listing museum exhibits were lost as well, and it was impossible to know exactly how many of them there had been. Roughly, though the museum had contained about 150,000 items plus another 110,000 in a special wing for seashells, bringing the total to 260,000 or so. Among these were about 700 earthenware vessels excavated within the city limits, and about 500 bags of archaeological materials related to shell middens.

Some people volunteered to assist with the recovery efforts, starting with materials related to the Yoshida-ke Monjo (documents of the Yoshida clan), and the work began in April. The door to the storage room that housed these documents had been pushed shut by the flow of water, and thus the documents were not washed away. They were soaked in seawater, however, and in order to prevent them from drying out in this state, they were placed in plastic bags and transferred to a storage room on the second floor. After this came the administrative documents. As for the shells, about half of them had been washed away.

There happened to be an elementary school that had just ceased operating at the end of March, and the school building served as a venue for the restoration of the exhibits, or more accurately the preliminary stabilization work before the restoration. The liquid that had soaked the items was more sludge than seawater, and to wash this out, the items first had to be rinsed gently in tap water, and then in purified water. The seashells and other objects were disinfected using ethanol.

People from all walks of life came to assist with the restoration and shared their insights, noting for instance that the seawater contained chemicals and it was also necessary to wash these out. Currently a wide range of innovative restoration and stabilization experiments are still in progress.

As for the works of art in the museum, the curators in charge of these had perished in the disaster, and no one had the expertise to restore them. The region was cut off from other parts of Japan, and help was late in arriving.

A timeline of the recovery efforts:

May 6: The Cultural Affairs Agency is reached on the phone, and help requested.

May 12, 16: Cultural Affairs Agency personnel arrive on site.



Fig. 9 The items first had to be rinsed gently in tap water (right), and then in purified water (left) (Copyright: The Rikuzentakada Municipal Museum)

June 18: Members of the Japanese Council of Art Museums come to survey the museum.

July 12, 13, 14: Works of art begin to be transported to Iwate City and fumigated.

September 29: The last pieces are transported to the Iwate Museum of Art.

The recovery plan calls for complete restoration by 2018. However, the low-lying land in areas devastated by the tsunami cannot be used as it is vulnerable to future disasters expected to strike, and the new museum must be built on high ground that is currently being rezoned. Construction of the museum must wait until temporary housing for evacuees has been removed, and must rely on government subsidies, though it is not clear when these will be forthcoming. Considering specialized needs like air conditioning and fumigation, it would be preferable to give the museum its own separate building, but it seems likely to be



Fig. 10 Members of the Japanese Council of Art Museums are coming by June 18 (Copyright: The Rikuzentakada Municipal Museum)



combined with a culture center, library and so forth. However, it is unclear whether the central government will pay the construction costs, and the future of the museum is in doubt. (More details about the disaster damage condition of Rikuzentakata Municipal Museum, please see the link as below for reference <http://www.rekihaku.ac.jp/others/img/kesennuma/110730/002.pdf>)

## II. Ishinomaki Cultural Center

This facility was located only 200 meters inland. A 6-8 meter tsunami struck it, and seawater and sludge reached the ceiling of the second floor. There were paper and glue factories in the vicinity, and the black sludge that washed over the cultural center contained raw pulp materials, wet pulp, crude oil, and chemicals from the glue factory. The water pressure broke the door of the storage area wide open, and the current swept in all manner of debris.



Fig. 11 Temporary Rikuzentakata Municipal Museum (ex-elementary school) (Copyright: The Rikuzentakada Municipal Museum)

The second-floor storeroom containing the Mori Collection happened to have been subsidized by the central government, and had a very well sealed door. Thanks to this door, although the wave was as high as the ceiling, only five centimeters of water flooded the storeroom, and the collection was not damaged.

One of the staff members remains missing. A female curator, she had been sent home early, and apparently met with disaster while evacuating. The other two curators left later by car, but when the wave approached they quickly ran up to the fourth floor of a police station where they were safe. As the missing curator was the one in charge of fine art, it took a long time to assess the status of the art collection, and recovery and restoration work did not progress smoothly.

Art rescue efforts began on April 7 when contact was established with Murakami Hiroya, the chief curator at the National Museum of Western Art and a representative of the Japanese Council of Art Museums, and a request was made for assistance. In late April, members dispatched from the Japanese Council of Art Museums began transporting the exhibits to the Miyagi Museum of Art. The Ishinomaki Cultural Center had also lost the ledger listing its exhibits.

Happily, however the Cultural Center had been maintaining contact with the Miyagi Museum, and the museum had a good picture of what the center contained and what most needed to be recovered. As a Miyagi prefectural facility, the museum is now playing an active role in rescuing works of art and providing support to facilities in the prefecture. For example, they are currently exhibiting the sculptures of Takahashi Eikichi, which were recovered from the damaged Center.

### **III. The Miyagi Museum of Art**

Sendai, the urban center of Miyagi Prefecture, was rocked with a seismic intensity of nearly 6. However, the museum suffered only minor damage thanks

to its sturdy construction, while many other buildings and outdoor sculptures near the museum were woefully damaged.

As for the damage inside the museum:

- i. Some unglazed ceramics by young artists in the second-floor gallery fell.
- ii. Glass in wall-hung display cases broke (on the first and second floors).
- iii. Glass broke again, in a display case in the first-floor permanent collection, in an aftershock on April 7. Luckily, the contents of the case had been removed to avoid further damage in what proved to be a wise precautionary measure.

It is fortunate that after the Kobe earthquake, experts declared that there was a 99% chance of an earthquake striking Miyagi within ten years, and all kinds of earthquake countermeasures had been taken. Some examples are listed below.

- i. The separate Churyo Sato Gallery

The pedestals of sculptures were weighted at the bottom with iron weights that brought the center of gravity extremely low. Connecting the sculptures to the pedestals with iron bars and tightly bolting them in place was also an effective measure. The larger sculptures were given seismically isolated quake-resistant bases, which also proved effective. (Apparently at some other museums similar bases failed to work because the quake vibrations overrode the seismic isolation.)

- ii. Louvered ceilings

The louvers were properly suspended from the ceiling, and while some came loose, none of them fell and no museum visitors were injured. This ceiling structure proved to be an effective one.

- iii. Emergency art-rescue materials

Because the museum has a sculpture wing, it stocked a lot of wrapping and

packaging material, which was turned to use for post-disaster rescue of artwork.

The museum is built on a large tract of land, containing a shed for landscaping equipment equipped with water and electricity, which was used to store the Ishinomaki Cultural Center exhibits. There they were cleaned and had mold removed. Of the works of fine art, three-dimensional ones were cleaned and restored at Tohoku University of Art and Design. Paintings were taken to the National Museum of Western Art and the Kanagawa Prefectural Museum, and archaeological materials were transported to the Miyagi Museum.

The Ishinomaki Cultural Center had had the ledger listing its exhibits washed away, but a collection committee at the prefectural museum had been keeping track of the collection, and had a good idea of what items they were looking for. They searched for these items at the site among heaps of debris. To the uninformed, of course, some contemporary art looks just like debris.

It will be a while before exhibitions can be mounted in Ishinomaki again, so the prefectural museum is considering establishing a special area for Ishinomaki exhibits.

It is clear that museums need to take disaster countermeasures. In this case the lessons of the 1995 earthquake had been well learned. Particularly effective were the steps taken to protect sculptures, like quake-resistant pedestals, and the protective mechanisms for shelves and flat-file cabinets in storage areas.

## **Lessons to be obtained from the Great East Japan Earthquake**

### **i. Museum location**

Museums ought to be built in areas where they will be shielded from disasters, which mean not locating them near the sea or rivers. It is also essential

to research local lore and legends about a given area to see if it seems disaster-prone.

Right now in Japan archaeologists and ethnologists are working to unearth records of past disasters, which could give hints to when and where the next once-in-a-millennium catastrophe might occur.

- ii. Museums should make multiple copies of their records, and some of these copies should be stored in a separate location away from the museum building.
- iii. Doors to storage rooms ought to be rigorously designed so as to seal tightly.

## **Conclusion**

Unfortunately, human civilization will never be free of the threat of natural disasters. While we cannot avoid them completely, with foresight and effective countermeasures it is possible to mitigate the damage they cause. We must have systems in place to protect both people and important cultural assets from disasters, and to recover and restore cultural assets as quickly as possible when disasters do strike. While Japan is a disaster-prone nation with numerous challenges to overcome, its museums have been reinforcing their own countermeasures and strengthening networks, involving the Japanese Council of Art Museums and the Cultural Affairs Agency, that are dedicated to assisting damaged museums. These initiatives grew out of the lessons learned from the Great Hanshin-Awaji Earthquake of 1995. One of the duties of every museum employee is to take every possible step to minimize damage from potential disasters, and to share ideas with their colleagues and peers.

Natural disasters and effective countermeasures against them are a topic that merits discussion and deliberation across national borders. I am extremely

grateful for the opportunity to share my insights in the pages of this journal.



Fig. 12 Art works are transferred to the Miyagi Prefectural Museums of Art (Copyright: Yujiro Ochi)