Training Report
on
Cultural Heritage Protection

Training Course for Researchers in Charge of Cultural Heritage Protection in Asia and the Pacific 2008 –Uzbekistan –

16 July – 18 August 2008, Nara, Japan

Cultural Heritage Protection Cooperation Office,
Asia/Pacific Cultural Centre for UNESCO (ACCU)

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Cultural Heritage Protection Cooperation Office,
Asia / Pacific Cultural Centre for UNESCO (ACCU)

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Practical training on stabilization treatment of metal objects at NNRICP

Microscopic observation of metal artefacts at Conservation Science Section of NNRICP

Mr NISHIMURA awarded a certificate of completion to Mr Boliev at ACCU Nara Office.

After the closing ceremony, a commemorative picture was taken with ACCU staff.

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Preface

Preface

The Cultural Heritage Protection Cooperation Office, Asia/Pacific Cultural Centre for UNESCO (ACCU) was established in August 1999 with the purpose of serving as a domestic centre for promoting cooperation in cultural heritage protection in the Asia- Pacific region, and will celebrate its 10th anniversary this year. Since its inception, our office has been implementing a variety of programmes to help promote cultural heritage protection activities, promoting close cooperation with the Agency for Cultural Affairs, Japan (*Bunkacho*); National Institutes for Cultural Heritage, National Research Institute for Cultural Properties; the Nara Prefectural Government; the Nara Municipal Government; universities; and museums.

The ACCU Nara's activities include, training programmes for the human resources development, international conferences and symposia, the training of young leaders in cultural heritage protection supported by the UNESCO/Japan Funds-in-Trust, the website for the dissemination of information relating to cultural heritage protection, and the world heritage lectures in high schools. In addition to those, ACCU Nara Office has begun offering "the Local Training Workshop" which dispatches a group of lecturers from Japan and implements the practical training on cultural heritage protection on sites. We have also set up the system of "International Correspondents" for the purpose of establishing closer ties with the countries in the Asia-Pacific region, and appointed the correspondents from each country, who will periodically send reports on cultural heritage protection in their country.

Our office has been conducting two types of the training course: the group and the individual. The group training course offers the opportunity to 16 specialists for about one month with two themes on alternate year: "Preservation and Restoration of Wooden Structures" and "Research, Analysis, and Preservation of Archaeological Sites and Remains." Meanwhile, the individual training course is organized for a few researchers from one country on the specific theme according to their requests.

Three researchers were invited to the Individual Training Course 2008 from the Republic of Uzbekistan: Institute of Archaeology, Fine Arts Research Institute, and the State Museum of the History of Uzbekistan respectively. They had been engaged in excavation, conservation and documentation of the archaeological artefacts in Uzbekistan. In response to participants' requests,

this programme was organized to provide them with basic knowledge on the museum management and practical training on conservation treatment of metal objects. Furthermore, they had opportunities to be exposed to as many museum displays as possible. I am assured that they will make the best use of what they have acquired in the cultural heritage protection activities back in Uzbekistan.

Finally, I would like to express my sincere appreciation to the Agency for Cultural Affairs, Japan (*Bunkacho*), National Research Institute for Cultural Properties, Archaeological Institute of Kashihara, MIHO Museum, Okayama Orient Museum, Ancient Orient Museum, Tokyo National Museum and Soka University for their cooperation and support.

NISHIMURA Yasushi
Director
The Cultural Heritage Protection Cooperation Office,
Asia/Pacific Cultural Centre for UNESCO (ACCU)

I. Introduction

1. General Information
2. Programme Schedule

1. General Information

Training Course on Cultural Heritage Protection in Asia and the Pacific 2008 - Uzbekistan -

(16 July－18 August 2008, Nara)

1. Organisers

The course is jointly organised by *Bunkacho* (Agency for Cultural Affairs, Japan); Asia/Pacific Cultural Centre for UNESCO (ACCU); and National Institutes for Cultural Heritage, Nara National Research Institute for Cultural Properties.

2. Background

The Republic of Uzbekistan is a landlocked country in Central Asia bordering Kazakhstan to the north, Turkmenistan and Afghanistan to the south, and Tajikistan and Kyrgyzstan to the east. At ancient times, the central region of the country prospered as key junctions of trade between east and west with flourishing oasis towns. The prospective participants in this training course belong to the State Museum of History of Uzbekistan; Fine Arts Scientific Research Institute, Academy of Arts of Uzbekistan; and Institute of Archaeology, Uzbekistan Academy of Sciences respectively and have been actively engaged in excavation of sites, conservation of artefacts, and museum work. Huge quantities of ancient coins have been excavated from the sites and stored in the museum without any conservation treatment. So, it is urgent need to preserve and to restore those coins and other metal objects for better utilization; those unearthed coins, if conserved properly, can be displayed in the museum. Therefore, the organizers have decided to invite three promising researchers from Uzbekistan for the better museum management and for the protection of cultural heritage in the country by providing them with systematic knowledge and practical technique in Japanese museums such as the methods of data collection and reposition, display methods, educational dissemination activities, restoration technique of artefacts, and conservation science.

3. Date and Venues

Date: 16 July (Wed.) to 18 August (Mon.) 2008. [34 days]

Venues: Cultural Heritage Protection Cooperation Office, ACCU (ACCU Nara); Facilities and museums of cooperating organizations, etc.

4. Objective of the Training Course

A sequence of the individual training course aims at mainly providing participants with the opportunity to master the basic knowledge and practical technique on conservation science of metal objects, to be useful for the conservation of numerous coins unearthed from the sites in Uzbekistan. For effective utilization of those archaeological artefacts after conservation treatment, the training course also provides them with opportunity to learn the repository system, management system, display methods, social education, and utilization of the museum in Japan, which will accordingly contribute to the protection of cultural heritage in Uzbekistan.

5. Training Curriculum

- Introduction to Conservation Science and its Treatment
- Observation and Documentation of Archaeological Artefacts
- Reinforcement Treatment for Artefacts
- Registration System for Artefacts Management
- Organization of Unearthed Artefacts
- Microenvironment and Environmental Control Systems in Museum
- Cleaning Methods of Metal Objects
- Desalination and Stabilization of Metal Objects
- Methodology for Museum Display
- Practical Training on Museum Work

6. Participants

Bakhriddin Niyozovich BOLIYEV (Mr)

Researcher, Institute of Archaeology, Academy of Sciences of Uzbekistan
Date of Birth: 9 May 1967 (Age 41)

Akmal Fozilovich ULMASOV (Mr)

Junior Scientist, Fine Arts Scientific Research Institute, Academy of Arts of Uzbekistan
Date of Birth: 16 June 1978 (Age 30)

Aleksey Nikolaevich GORIN (Mr)

Junior Research Assistant, State Museum of History of Uzbekistan, Academy of Sciences of Uzbekistan
Date of Birth: 1 June 1980 (Age 28)

7. Process of Invitation

The member of Japan Consortium for International Cooperation in Cultural Heritage (JCIC-Heritage) recommended three applicants suitable for the above mentioned invitation programme as participants. Then ACCU Nara Office has determined to accept three applicants as participants through close examination.

8. Others (Past achievement to accept trainees)

Since 2000 when the above-mentioned invitation programme started, twenty-six participants from eleven countries have been accepted.

9. Certificate

Each participant will be awarded a certificate upon completion of the course.

10. Language

The main working language of the course is Russian.

11. Expenses

Expenses for the training course will be borne by ACCU and comprise the following:

(1) Travel expenses:

Each participant will be provided an economy-class return air ticket between the international airport

nearest to their residence and Kansai International Airport, and domestic transportation costs to and from the airports and between the training venues in Japan.

(2) Living expenses:
Participants will be provided daily subsistence allowances during the training course, beginning from 15 July (Tue.) to 19 August (Tue.) 2008. Arrangements for accommodations will be made by ACCU Nara.

12. Secretariat

Cultural Heritage Protection Cooperation Office,
Asia/Pacific Cultural Centre for UNESCO (ACCU Nara)
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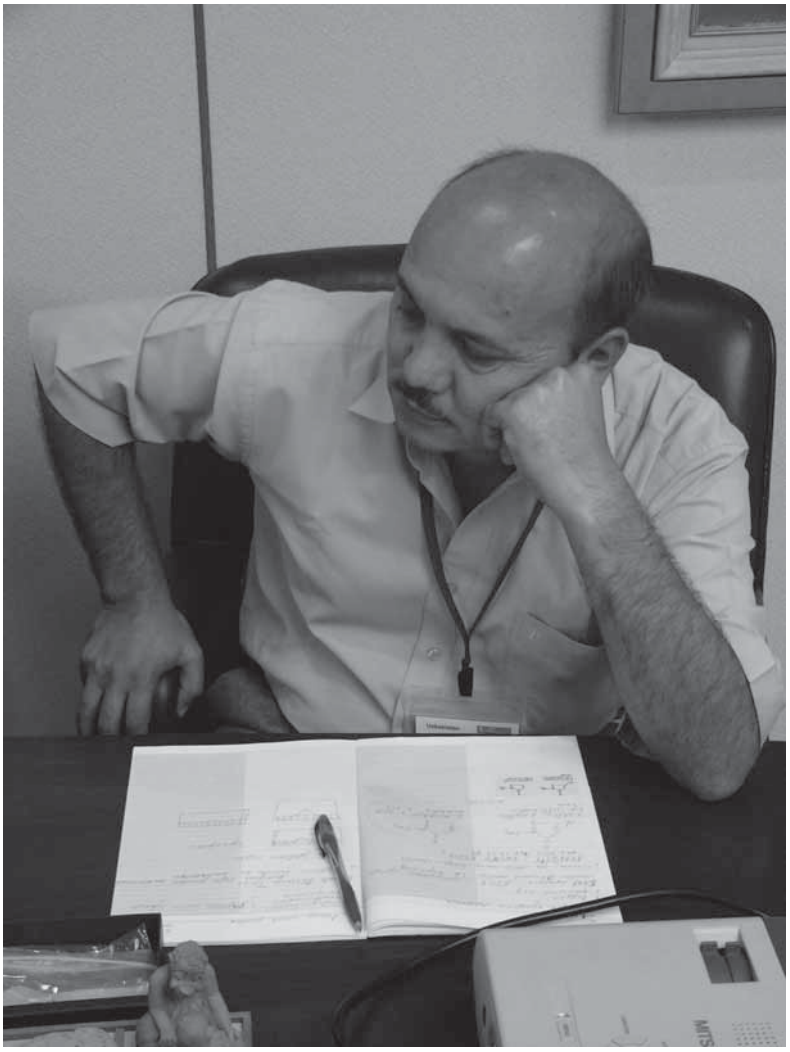
2. Programme Schedule

Date			Lecture	Venue
July	16	Wed.	Opening Ceremony /Orientation	ACCU Nara
	17	Thu.	Lecture: Introduction to Conservation Science and its Treatment	NNRICP
	18	Fri.	Microenvironment and Environmental Control Systems in Museum	
	19	Sat.		
	20	Sun.		
	21	Mon.	National Holiday	
	22	Tue.	Observation and Documentation of Archaeological Artefacts	NNRICP
	23	Wed.	Lecture: Cleaning Methods of Metal Objects I	
	24	Thu.	Workshop: Cleaning Methods of Metal Objects II	
	25	Fri.	Workshop: Cleaning Methods of Metal Objects III	
	26	Sat.		
	27	Sun.		
	28	Mon.	Desalination and Stabilization of Metal Objects	NNRICP
	29	Tue.	Reinforcement Treatment for Artefacts	
	30	Wed.	Treatment for Filling and Shaping	
	31	Thu.	Lecture: Summary of Conservation Treatment and Handling of Equipments	
August	1	Fri.	On-site Lecture I: Cultural Properties in Kyoto	Kyoto
	2	Sat.		
	3	Sun.		
	4	Mon.	On-site Lecture II: Visiting Excavation Site in Nara Prefecture	AIKNP
	5	Tue.	Methodology for Museum Display	AIKNP Museum
	6	Wed.	Registration System for Artefacts Management I	AIKNP
	7	Thu.	On-site Lecture III	MIHO Museum
	8	Fri.	Registration System for Artefacts Management II	AIKNP
	9	Sat.	On-site Lecture IV	Okayama Orient Museum
	10	Sun.	On-site Lecture V <***Travel from Okayama to Tokyo***>	
	11	Mon.	Practical Training in Museum I	Ancient Orient Museum
	12	Tue.	Practical Training in Museum II	
	13	Wed.	Practical Training in Museum III	Tokyo National Museum
	14	Thu.	Practical Training in Museum IV	
	15	Fri.	Practical Training in Museum V	The University of Tokyo etc.
	16	Sat.	Presentation at Soka University:	Soka Univesity
	17	Sun.	***<Travel from Tokyo to Nara>***	
	18	Mon.	Submission of Final Reports / Closing Ceremony	ACCU Nara

ACCU Nara: Cultural Heritage Protection Cooperation Office, Asia/Pacific Cultural Centre for UNESCO
NNRICP: Nara National Research Institute for Cultural Properties
AIKNP: Archaeological Institutes of Kashihara, Nara Prefecture

Ⅱ. Summary of Lectures



Summary of Lectures

16 July (Wed.)

Opening Ceremony

The opening ceremony was held at ACCU Nara Office. Three participants from Uzbekistan, Mr Boliev, Mr Ulmasov and Mr Gorin, had an orientation on the training schedule. After that, they took a tour of world heritage sites in Nara City: Todaiji Temple *Daibutsuden* (Great Buddha Hall) and *Hokke-do* (Lotus Hall) etc.

17 July (Thu.)

Lecture: Introduction to Conservation Science and its Treatment <Mr Kohdzuma and Mr Wakiya / NNRICP>

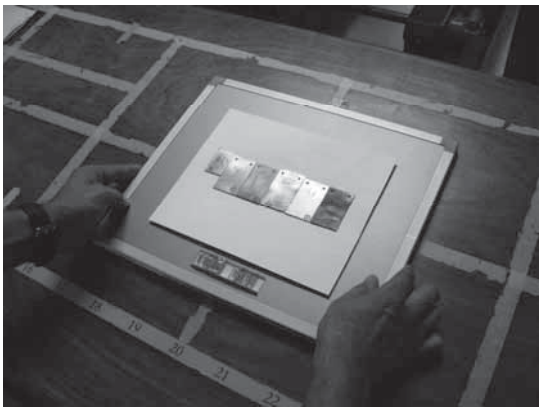
- A lecture on conservation science methods in Japan and its practices for metal artefact
- Information was collected on conservation methods in Uzbekistan from participants.
- Based on that information, observation method of metal object was learned; Participants observed aging degradation of modern Japanese coins with a magnifying glass.

Discussion at the Conservation Science Laboratory

18 July (Fri.)

Lecture: X-ray Photography of Archaeological Artefacts /Workshop: Taking X-ray Photographs <Mr Wakiya / NNRICP>

- An outline of instruments such as stereoscopic microscopes and fluorescent X-ray analyzers which are used for preliminary analysis
- Practical training on device operation; how to take X-ray photograph
- After taking X-ray photograph of pieces of metal, which are made of different materials and with various thickness, participants observed differences of the image due to conditions: change of voltage, electric current, exposure time, distance from X-ray source, thickness of objects and atomic numbers.
- Discussion on the important reminder of taking X-ray photography



Taking X-ray photograph of various metal objects under different conditions

Observation of old coins with stereoscope

Viewing three-dimensional image of satellite photographs

Mechanical cleaning of a bronze artefact with a graver(left) and a brush (right)

22 July (Tue.)

Workshop: X-ray Photography of Atrefacts

<Mr Wakiya / NNRICP>

- Observation of the surface of old coins unearthed from the Kofukuji Temple with stereoscopic microscopes: their colour, hue and state of rusting.
- Taking X-ray photographs of the same old coins to determine how their observations are radio-graphically manifested.

23 July (Wed.)

Lecture: The Principles of Fluorescence X-ray Analysis / Workshop: Fluorescence X-ray Analysis <Mr Wakiya / NNRICP>

- A introductory lecture on the theory of fluorescent X-ray devices
- Practical training on component analysis by using fluorescent X-ray devices
  - Participants observed variances in composition in different parts of the same coin, and discussed the precautions for composition analysis.
- Taking X-ray photographs under better conditions based on yesterday's radiographs
- By comparing radiographs and surface observation, participants confirmed what to pay attention while cleaning the old coins.

24 July (Thu.)

Cleaning Method of Metal Objects I

<Mr Wakiya / NNRICP>

- Removing rust and mud, adhered to the surface of coins, by using grinders, air-brasive systems, bamboo skewers, superfine paint-brushes and scalpels
- Cleaning was performed while paying attention to the areas of cracks shown in radiographs.

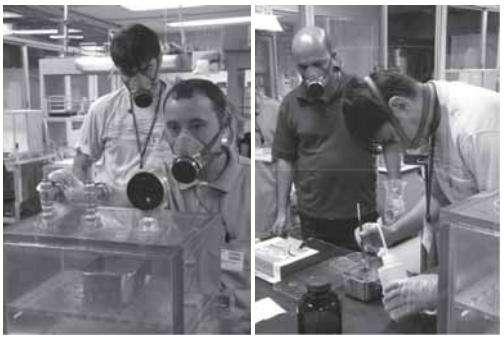
- Practical training on rust removal by using super-absorbent polymer
- After the preliminary treatment of cleaning, alcohol was used for dehydration.

25 July (Fri.)

Cleaning Method of Metal Objects II

<Mr Wakiya / NNRICP>

- A lecture with a slide presentation on the process of conservation treatment of bronze gilt horse riding gear excavated from the Fujinoki Burial Mound in Ikaruga Town
- After cleaning, the old coins were treated with benzotriazole (BTA) solution for stabilization.



Preparation of BTA solution for stabilization treatment for metal objects

28 July (Mon.)

Worksop: Taking X-ray Photography of Atrefacts

Lecture & Workshop: Reinforcement Treatment of Artefacts <Mr Kohdzuma and Mr Wakiya / NNRICP>

- A lecture on X-ray diffraction method used for structural analysis of rust on metal objects
- Rust was scraped from the unearthed ironware and used as a sample for analysis with a rotating anode X-ray diffracto-meter.
- A lecture and practical training on stabilization treatment of metal objects using *Paraloid B72*
- X-ray diffraction analysis of bronze artefacts excavated from Kofukuji Temple sites

29 July (Tue.)

Packing of Artefacts

Non-destructive Analytical Technique <Mr Wakiya and Ms Tamura /NNRICP>

- Cleaning of old coins (continued)
- Taking radiographs of old coins (CR method)
- How to store treated coins (RP system)

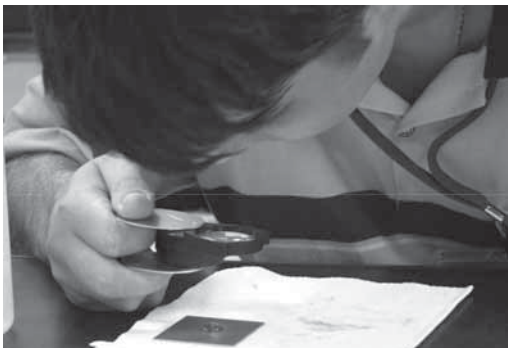
Stabilization treatment of old coins after cleaning

30 July (Wed.)

On-site Lecture: Visiting World Heritage Sites in Nara City <Mr Kohdzuma and Mr Wakiya / NNRICP>

Observation of Jigokudani, stone cave, in Kasugayama Mountain

A collection of old coins stored at NNRICP after conservation treatment



Observing the state of rust on the surface

Observation tour of Kiyomizu-dera Temple in Kyoto

- Practical training on stabilization of old coins with *Paraloid B72* after cleaning and Benzotriazole (BTA) treatment
- Participants had a guided tour of
  - ♦ the Heijo Palace Site Museum and learned the technical issues on exhibition of the exposed archaeological site.
  - ♦ Wakakusa-yama Mountain and viewed the geographical relationship between Heijo Palace Sites and Kofukuji Temple.
  - ♦ Jigokudani *Sekkutsu* (Stone Cave) and observed the geological features of the cave as well as the conservation environment.

31 July (Thu.)

Consolidation and Joining of Artefacts

Environmental Control for Artefacts

<Mr Kohdzuma and Mr Wakiya / NNRICP>

- A lecture on environment for storage of archaeological artefacts: optimum temperature and humidity
- Applying final cleaning treatment to old coins having undergone conservation and stabilizing treatment

1 August (Fri.)

On-site Lecture I: Visiting Cultural Properties in Kyoto < Mr Kohdzuma and Mr Wakiya / Kyoto>

- Visiting the World Heritage sites in Kyoto: Kiyomuzu-dera Temple, Yasaka-jinjya Shrine, Nijo-jo Castle and Kinkaku-ji Temple

4 August (Mon.)

On-site Lecture II: Visiting Excavation Site in Nara Prefecture <Mr Hashimoto, Mr Motomura, Mr Okada, Mr Mizuno, Mr Okuyama, Mr Takahashi and Mr Hirose / Nara Pref.>

- Participants had a guided tour of archaeological excavation sites in Nara Prefecture and had practical training on excavation methods in Japan.

Explanation of sedimentary layers (left) and of excavation of artefacts at Gose city excavation site, in Nara Pref.

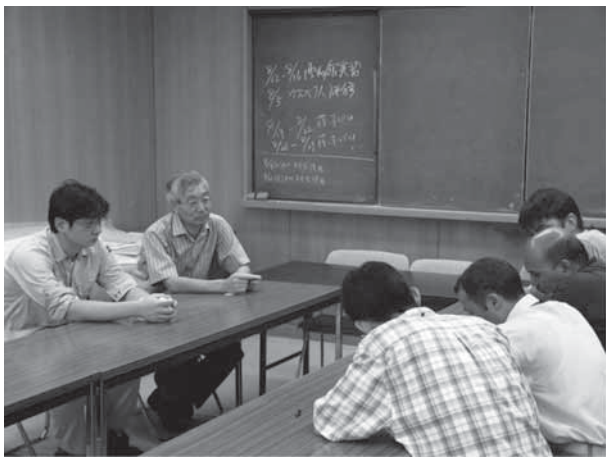
At Hinokuma-dera Temple site in Asuka-mura Village

5 August (Tue.)

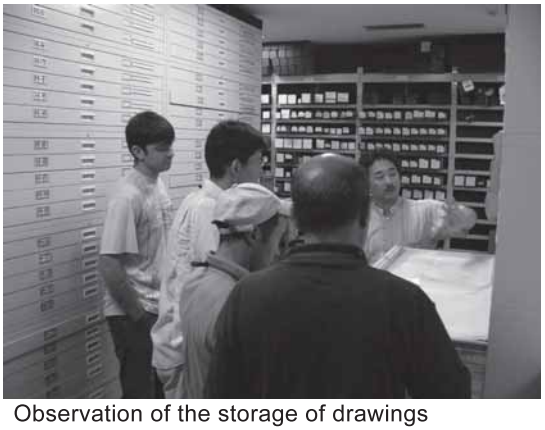
Methodology for Museum Display <Mr Kitai / The Museum AIKNP>

- Observation: how archaeological artefacts are displayed at the exhibit room of the museum
- Observation of the support facilities of the museum: the general storage, storage for valuables, cataloguing and organisation rooms, photo-studio and archives
- Participants practically learned how artefacts were stored and managed in systematic ways.
- The director of the museum held a question and answer session for them to clarify unclear issues about the museum.

Observing the storage rooms of the Museum, guided by Mr Kitai



Discussion and exchange of views with Mr Matsuda, the Director of the Museum AIKNP



Observation of the storage of drawings

Observing a collection of Bactria coins stored in MIHO Museum

Explanation of display methods for mosaic tile works at MIHO Museum

6 August (Wed.)

Registration System for Artefacts Management <Mr Toyo-oka / AIKNP>

- Practical training on the management procedure of unearthed artefacts

Treatment of excavated artefacts:

- ♦ washing with water
- ♦ observation and writing notes
- ♦ joining, restoration and colouring
- ♦ registration
- ♦ photography

- Methods for managing and organising photographs, drawings and books
- Methods for colouring of restored earthenware

7 August (Thu.)

On-site Lecture III: Visiting MIHO Museum <Mr Inagaki / MIHO Museum >

- Observation of the exhibit cases, the lighting systems and other facilities of the permanent collection exhibition rooms
- A lecture on the display methods for the special exhibition in the museum
- A lecture was given on how display cases and lighting were selected for the collection in the special exhibition, and participant observed what they learned.

Lecture on outlines of MIHO Museum, followed by question and answer session

8 August (Fri.)

Conservation Science of Artefacts <Mr Okuyama / AIKNP>

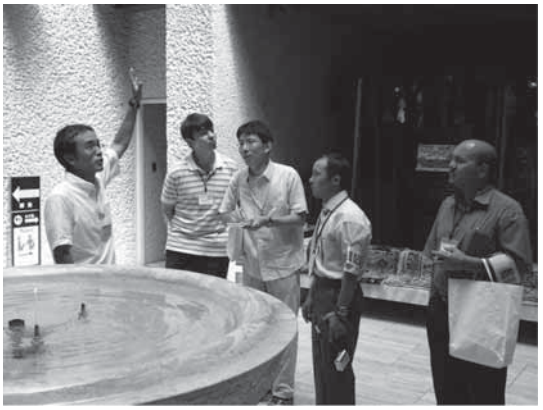
- A lecture on three-dimensional measurement: its theory and effectiveness
- Practical training:
  - three-dimensional measurement: measuring ancient bronze mirrors
  - identification of tree types: participants made permanent preparations from unearthed wooden artefacts and determined wood types by comparison with standard wood specimens through microscopic observation

Viewing the image of three-dimensional measurement on the screen

9 August (Sat.)

On-site Lecture IV: Visiting OKAYAMA Orient Museum <Mr Sudo / Okayama Orient Museum >

- Museum tour and observation of special exhibition, “The Blue Splendors of Uzbekistan - Journey to the Silk Road Oases through Works of Art and Photographs”



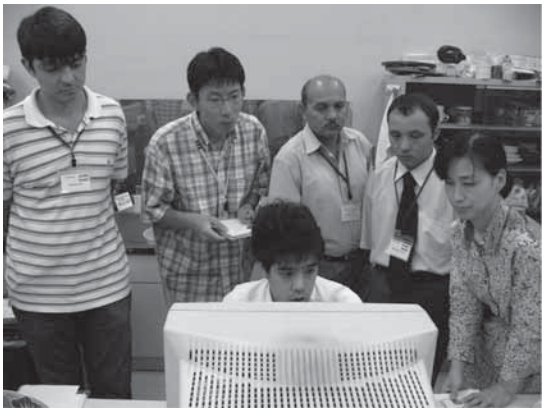
Mr Sudo showed around the display of the museum

10 August (Sun.)

On-site Lecture V: Visiting OKAYAMA Orient Museum <Mr Sudo>

- Museum tour and observation of special exhibition (continued)
- Display methods and ideal of the museum were leaned on the spot while looking around the museum.
- Storing and management system of collections were also learned.
- Three participants made presentations for general public on archaeological sites in Uzbekistan, and titles are as follows:

Mr Ulmasov, wearing traditional costume



Examining ancient game tools in hand

Transcription of cylinder seals to the clay

Mr Yamauchi made brief orientation around NRICPT.

- ♦ "Samarkand, Uzbekistan's First Capital" by Mr Bakhriddin Boliev
- ♦ "Buddhist Sites in Uzbekistan" by Mr Akmal Ulmasov
- ♦ "Kampyr-tepe, the Ancient Pier of the Oxus-Amu Darya River" by Mr Aleksei Gorin

11 August (Mon.)

Practical Training in Museum I <Mr Nakano, Ms Tsumura and Ms Miyashita / Ancient Orient Museum>

- − Museum tour under the guidance of Mr Nakano: observation of special exhibition in the museum
- − A lecture on display methods and lighting methods, most suitable for each specific collection and its problematic issues
- − Hands-on training on a registration system of collections housed in the museum by using a collection of old coins
- − A lecture on methodology of investigation, education and utilisation of amusement materials (ancient game tools) displayed in the museum

12 August (Tue.)

Practical Training in Museum II <Ms Ishida / Ancient Orient Museum>

- − A lecture on how to display cylinder seals
- − Practical training: transcription of cylinder seals to the clay
- − Guided tour around various facilities in the museum

13 August (Wed.)

Practical Training in Museum III <Mr Inoue and Mr Yamauchi / Tokyo National Museum>

- − Knowledge on lighting methods, effective

arrangement of works and selection of display cases was learned while observing the special exhibition in the museum

- Observation of the regular exhibition: works of Japanese Art, Oriental Art and Archaeological Artefacts etc.
- Participants also visited the National Research Institute for Cultural Properties, Tokyo, and the Japan Center for International Cooperation in Conservation under the guidance of Mr Yamauchi
- They also met Dr MAEDA Kosaku, who recommended them to this training programme as participants and exchanged information and views on archaeology of Uzbekistan.

Mr Inoue showed around storage facilities of the museum and lectured on work of the museum

14 August (Thu.)

Practical Training in Museum IV

<Mr Inoue / Tokyo National Museum>

- Observation of displays in the Gallery of Horyu-ji Treasures
- The selection of display cases and lighting methods to suit the collection were learned
- A lecture on the museum's mission in Japan and the system of the museum by Mr Inoue

15 August (Fri.)

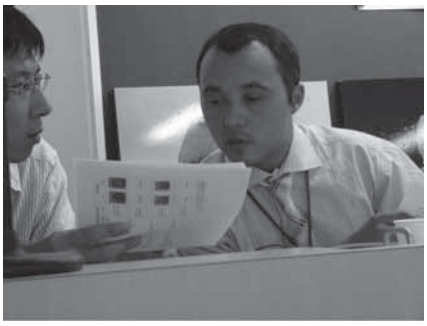
Practical Training in Museum V

<Mr Sugiyama / Tokyo University etc.>

Participants have a guided tour around Tokyo University by Mr Sugiyama.

- Yayoi-cho site in Hongo: its position in Japanese archaeological history
- Explanation of post-excavation display and information panels for recent remains on campus
- Visiting Nezu Shrine, which was designated as an important cultural property: observation of the Edo period shrine architecture style.

Under the guidance of Mr Sugiyama, visiting Yayoi-cho site and Nezu Shrine



They also visited Mr Hasegawa of Paret Co., Ltd. which deals in chemicals for conservation and restoration treatment, and learned the usage, instructions for use and properties of chemical agents by examining many samples of chemicals used for conservation.

16 August (Sat.)

Presentation at Soka University Silk Road Research Center

The titles of the presentations are as follows:

- "Dal'verzin-Tepe: An important place for Buddhist culture" by Mr Bakhriddin Boliev
- "Dal'verzin-Tepe: Its Urban Development and Architectural Ornamentation" by Mr Akmal Ulmasov
- "Dal'verzin-Tepe: Reviewing age-dating of the second Buddhist Temple site - Based on Archaeological Materials Unearthed in 2006 and 2007" by Mr Aleksey Gorin

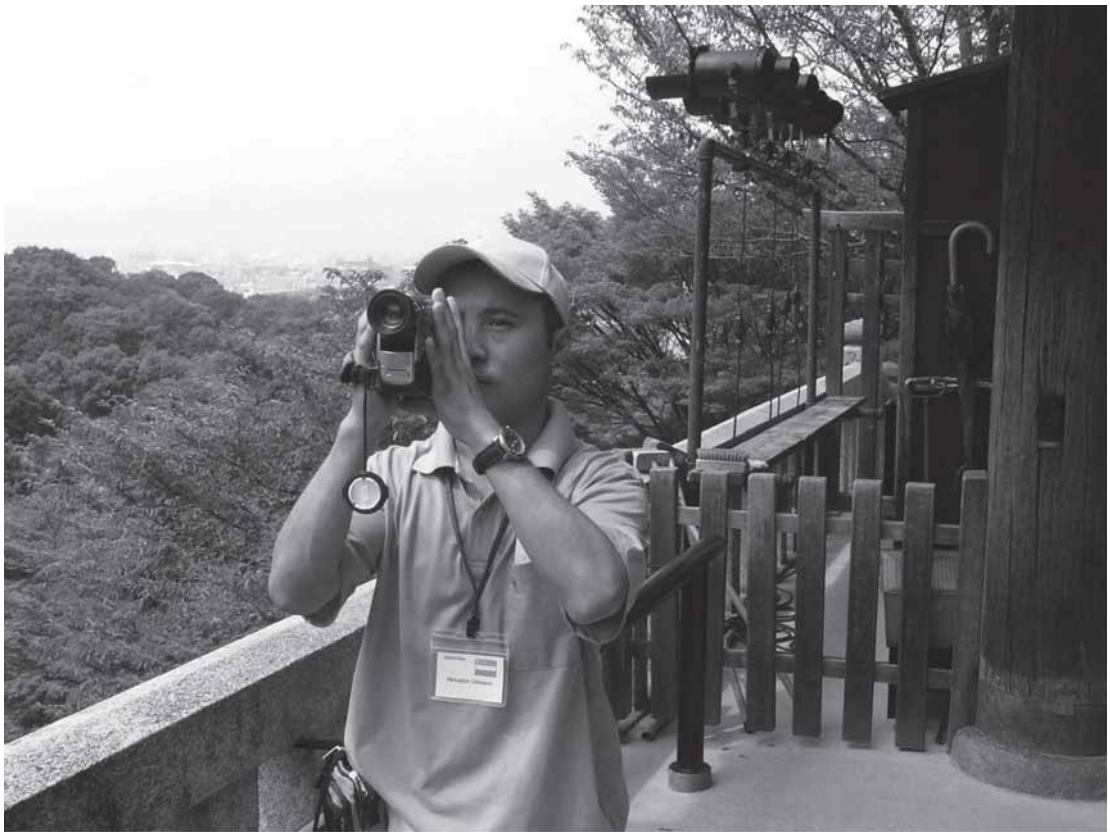
After each presentation, they have a discussion period with researchers in the seminar.

18 August (Mon.)

Submission of Final Report / Closing Ceremony <ACCU Nara>

Mr Nishimura, Director of ACCU Nara, awarded the certificate of completion to each participant.

Ⅲ. Participants' Country Reports



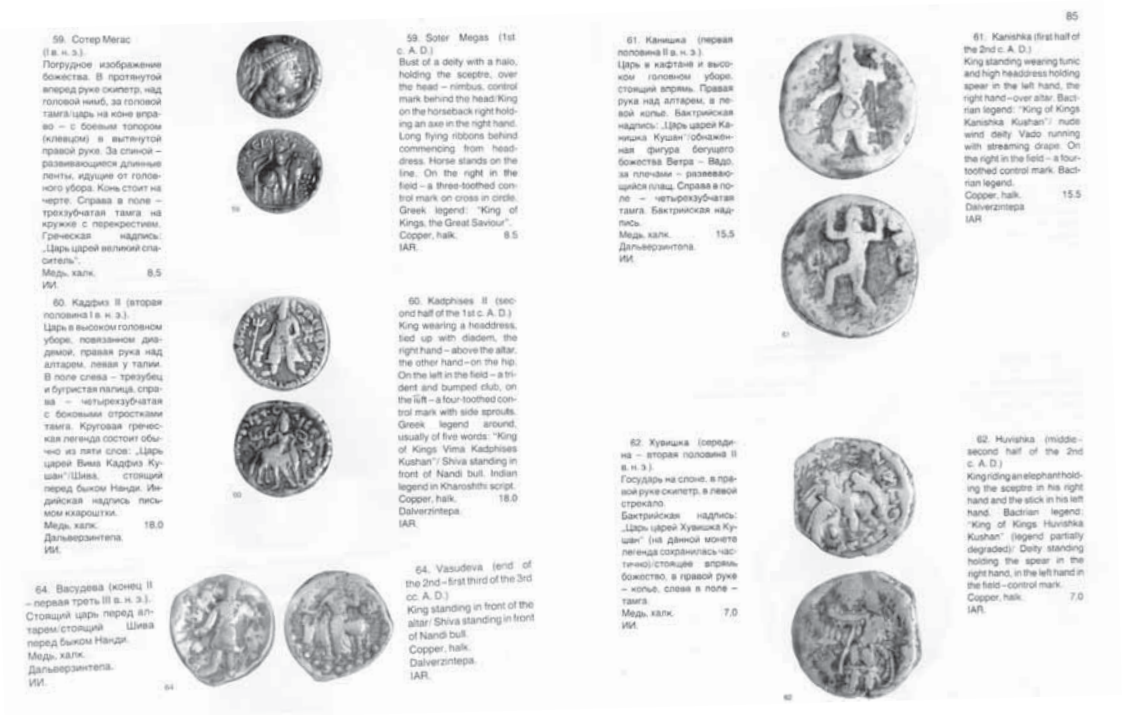
Country Report

Bakhriddin BOLIYEV
Researcher
Institute of Archaeology
Academy of Sciences of Uzbekistan

Metallurgy in the First to the Fourth Century in the Bactria

Metal products of the Bactria are exclusively researched based on excavated materials. This involves metal products, coins and casting molds. The research is conducted by experts such as archeologists, chemists, restorers and art scholars. This paper involves chemical composition of metal products. Those who conduct research in this field are V. Ruzanov, S. V. Levushkina and V. V. Luneva. Let us focus our attention on coins, the group which is most frequently unearthed.

Coins of the Kushan Dynasty have been researched over many years from historical, historical inscription and artistic perspectives, but chemical analysis had never been used for assessment. The following is a summary of the results of analyzing and assessing the chemical composition of coins. Discovered by Uzbek art investigation and Bactrian archeological teams when excavating archeological sites in Surkhandar' state, the coins are from between the second century B.C. and the fourth century A.D. Over 100 coins of the rulers of the Kushan Dynasty were studied.



Coins of the Kushan Dynasty

As a result of the study, it was determined that the majority of the Kushan coins were manufactured from copper and copper alloy. The coins that were studied were divided into eight groups based on similar chemical composition of typical metal impurities. Elemental impurities such as silicon, aluminum, calcium, manganese and magnesium were not taken into account. The reason for this is these elements are commonly contained in the composition of almost all rock that constitutes minerals. Let us classify the coins according to groups of mixed impurities.

Group 1: Alloy mainly consisting of copper (at least 90 percent). Impurities basically consist of 4 elements, i.e., cobalt, antimony, arsenic and tin.

Group 2: Alloy mainly consisting of copper. Only impurities found are cobalt, arsenic, tin and molybdenum.

Group 3: Copper impurities are cobalt, arsenic and tin. This is the most common group.

Group 4: Like Group 3, elements of 3 impurities can be found, i.e., cobalt, arsenic and molybdenum.

Group 5: Contains elements of a total of 2 impurities, i.e., cobalt and arsenic.

Group 6: Contains impurities cobalt and tin. There are several coins lacking cobalt in their composition.

Group 7: Includes two impurities, cobalt and molybdenum. Molybdenum is found in this group in the place of arsenic and tin.

Group 8: The coins of this group basically lack cobalt, antimony, arsenic, tin and molybdenum, and can be regarded as copper. Impurities contained in the composition of the majority of rock consisting of minerals include chemical elements such as silicon, aluminum, calcium, manganese and magnesium. This indicates that metal coins of this group are metallurgical products.

In response to the reduction of the number of impurities typical of bronze in its composition, the alloys used in the coins of the rulers of the Kushan Dynasty were classified in these eight groups. Group 1 contained elements of five [as given in the original] impurities, and the last group contains no impurities at all. From examples of change in chemical composition of alloys used in coins of Kushan emperors, it became clear that over several hundred years there was a shift from bronze of many constituents containing arsenic to bronze of a single constituent, after which there was a shift to a new simpler copper alloy, brass, of nature containing zinc with a single special added value.

As time passed and technology advanced from one generation to the next, experience was accumulated to determine the dependence relationship of characteristics of metal and combination of given characteristics. The various stages of the process were not only reflected in fundamental change such as transition from copper to bronze/brass, and subsequently to iron. Manufacturing methods of various coins at the time are recorded as type and amount of distinctive trace impurities for each period.

Chemical analysis of nonferrous metals unearthed by the excavation of Kampyrtepa is being conducted. Based on the content of impurities such as tin, lead, zinc, bismuth, antimony, arsenic and silver, they succeeded in

chemically finding seven groups. Each of the groups has a different chemical composition. The products of two of the groups have the most, i.e., group 1 which does not contain bismuth, antimony or arsenic as impurities, and group 7 which contains no more than 0.1% of bismuth and antimony respectively, and 0.1 to 0.5% of arsenic.

Nearby ruins of Airtam, Yalangtushtepa and Dal'verzintepa were cities that continued over a long period of time, but although the number of groups differs, the nonferrous metals unearthed from them can be chemically divided into similar groups based on their chemical compositions. The metals from the Airtam, Yalangtushtepa and Dal'verzintepa digs that were analyzed were 81%, 80% and 30% respectively, but they contain bismuth, antimony and arsenic, and primarily belong to group 7. Only an extremely small amount of the products fall under the remaining group, or no products at all. Metal of Kuchuktepa, which belongs to an earlier age, has been determined to belong to this group as well based on analysis of impurities. This group however has a high silver content. The compositions of the majority of the items unearthed contain a high percentage of silver, bismuth, arsenic and antimony.

Kushan Dynasty Period: This is the age of iron in which manufacturing ironware advanced to a high level. Work implements (tools), weapons, daily commodities and ornamentation were manufactured everywhere. Copper alloy of this period was especially used for casting coins, ornamentation and cosmetic utensils. Under the reign of Kadfize II, copper coins containing approximately 3% iron impurities was cast. The stability was lost for coins of subsequent emperors, and the coins reverted to their former degree of purity. The combination of iron and copper became widely used starting from the medieval heyday. As the percentage of iron in metal of the Kushan Dynasty increased, the amount of trace molybdenum impurities probably increased as iron began to be contained in the alloy.

Another feature of ancient metals is the existence of minute quantities of gold in their compositions. The percentage of gold fluctuates in the range of 0.001 to 0.1% in the oldest of them. Unlike metal of other city sites of the same age, 20% of the metal of Kampyrtepa contains gold impurities in copper alloy. In other words, gold impurities were found in 67% of the metals of Airtam, 71% of those of Yalangtushtepa and 67% of those of Dal'verzintepa. The majority of the products of these settlements may have been manufactured in the beginning of the Kushan Dynasty, or based on a stable production method, metallurgy may have firmly maintained a different tradition at the time of metal refining. The reason for this is because the manufacturing conditions which may apply at any age are not constant.

When we hear of ancient times for jewelry art of North Bactria, we are reminded of unique products, namely necklaces, bracelets, rings, earrings, hanging decorations, rings with set jewels, buttons and beads with highly aesthetic finish. A variety of pure gold jewelry has been discovered among the jewels unearthed at the site of the ancient city of Dal'verzintepa (DT-5), which are now referred to as the "hidden treasures of Dal'verzin."

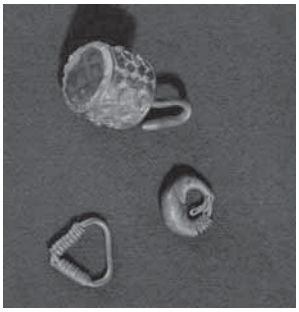
Hidden Treasures of Dal'verzin

Features of some of the hidden treasures are as follows:

1) Rolled bar with inscription

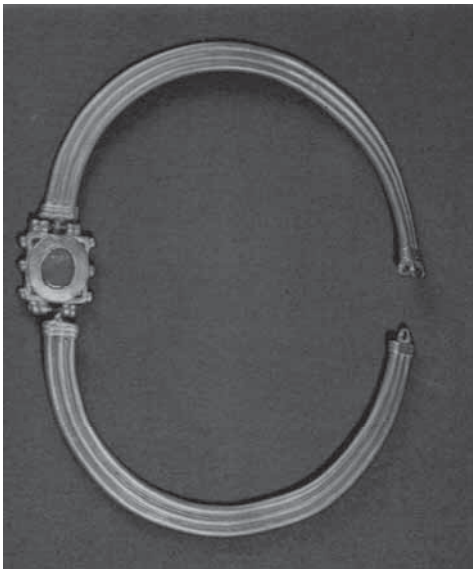
"Provided by the deity Mitra" is inscribed in Kharoshthi characters with inscription tools. The weight and purity of the gold is inscribed on other rolled bars. The weights are 897.27 and 358.29 grams

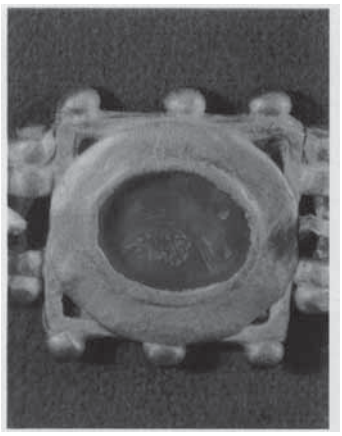
2) Earrings



The upper portions of the earrings are hollow cylinders decorated with a four-petal flower pattern lace. The inside has a delicate six-petal cereal flower pattern. A plate on which an arc in the shape of a serpent's head is mounted is soldered on the upper portion of the cylinders. It weighs 9.05 grams.

3) Torque with pendant



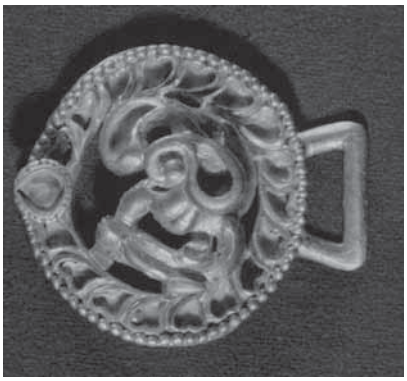


One side is a clasp and the other is neck decoration consisting of three concentric arcs connected by a square with a pattern, in which a jewel with a carved pattern expressing the head of Hercules is set. It weighs 215.56 grams.

4) Necklace (garnet, turquoise)

A necklace consists of a five braided cords. Each cord consists of eight wires braided like hair. The cords are fastened to holes in a plate above a cylinder shaped tube. The bottom of the tube is also covered with a plate with large holes fitted with garnets and turquoise. The stones are rounded. The necklace weigh 282.09 grams.

5) Buckle



Large buckle has soldered ear-shaped hole. It also has a hole for setting jewels surrounded by a belt shape, and a beast with large ears is expressed in relief. The buckle weighs 75.20 grams.

All hidden treasure ornaments are made of high purity gold and weigh a total of 32 kg. Various metals and alloys such as gold, silver and electron alloy were used in ornament fabrication. Various fabrication methods such as beating, hammering, joining, engraving, stretching, punch-out, casting and embossing were used according to the ornament's shape and application.

The most common method of fabricating ornaments was casting. Two stone molds were discovered when excavating the site of the city of Dal'verzintepa. The first mold was not very large. It was 62 × 30 × 15 millimeters and was an atypical form equilateral triangle. It was made of dark gray marble and was scrupulously polished. The hollow for casting was on one side only. The second mold was made more crudely. It was made of light gray shale and was 50 × 83 × 66 millimeters large. The casting hollow was on one wide surface and a vertical narrow surface on the rear side. A tiny graceful and delicate ring with the pouring chute was carved in the mold.

The mold is always warmed at the beginning of the casting process. If not, the mold will crack when it comes into contact with stretched metal. Also, the narrower and finer the casting hollow was, the more chance there was of the product not being accurately formed as a result the metal becoming cooled in advance. Along with enhancing plasticity of the product, heat treatment enhances strength when the product is reheated.

The fact that there are all sorts of jewelry produced by quality manufacturing clearly indicates that, of the various types of handicraft industries in North Bactria, jewelry fabrication occupied a significant position. The metal composition of each item of jewelry listed here contained as much as 3% high concentration of antimony, bismuth and arsenic. Similar compositions are seen in ruins of cities of other ages. These products may have been imported, but they perhaps reflect the creative pursuit of ancient jewelry craftsmen.

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Country Report

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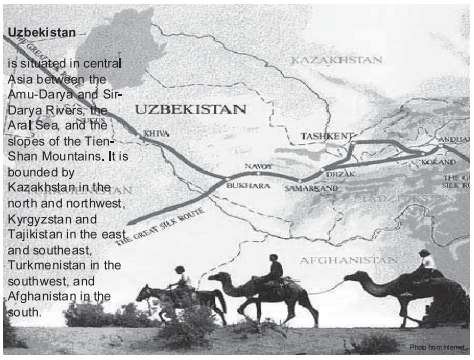
Preservation of Tangible Cultural Heritage and Preparation of Specialists in Uzbekistan

Uzbekistan is situated in central Asia between the Amu-Darya and Sir-Darya Rivers, the Aral Sea, and the slopes of the Tien-Shan Mountains. It is bounded by Kazakhstan in the north and northwest, Kyrgyzstan and Tajikistan in the east and southeast, Turkmenistan in the southwest, and Afghanistan in the south.



Uzbekistan is situated in central Asia between the Amu-Darya and Sir-Darya Rivers, the Aral Sea, and the slopes of the Tien-Shan Mountains. It is bounded by Kazakhstan in the north and northwest, Kyrgyzstan and Tajikistan in the east and southeast, Turkmenistan in the southwest, and Afghanistan in the south.

Photo from Internet

Uzbekistan is one of the most ancient regions of the world, where the development of world civilization has occurred over many millennia. Significantly, in its territory the states of Khorezm, Sogd, and Bactria were formed—coevals of antique Greece, Rome, and Akhemenid Iran. The Great Silk Road connecting East and West ran through here as well.

The great state known in history under the name of the Kushan Empire was formed in the south of Uzbekistan in the ancient period. The monuments of these times, such as majestic sites of ancient settlements, having some tens of hectares in area and preserved within the territory of the Republic, are objects of continual study by archeologists, critics, and architects of Uzbekistan, and in within the last decade, by numerous foreign experts as well, including those from Japan, France, Germany, the USA, Italy, and other countries.

Objects of history and art of great antiquity, found during archeological research in Afrasiyab, Kampyrtepa, Dalverzin Tepa, Varahshi, and tens of other places have been exhibited in various foreign countries.

Among such unique discoveries of ancient architecture there is a majestic palace of the Khorezmian governors (Toprak-kala) with plenty of smart halls (III century), numerous castles-keshki (Balalyk-tepa, VI-VIII centuries) a treasury of painting - a palace in Varahsha, being a residence of the Bukhara governors, whose halls are decorated with magnificent Shtuk and wall-painting, a palace of the governors in Afrasiyab with wall-paintings, the palace of the Termez governors and others..

Mural-wall painting. Reconstruction.
Balalk-tepa. South Uzbekistan

Photo by Ej Urasuj

Afrasiab mural – wall painting

Scanned from book. Abdurazzakov A.A

Owing to the achievements of science, great discoveries have been made in Uzbekistan. A brilliant and important culture, existing from the most ancient times, has been revealed. Among such unique

discoveries of ancient architecture are: a majestic palace of the Khorezmian governors (Toprak Kala, 3rd century) with many impressive halls; numerous castles (*keshki*), such as Balalyk Tepa, 6th-8th centuries, a treasury of painting; the palace in Varahsha, being a residence of the Bukhara governors, whose halls are decorated with magnificent Shtuk and wall paintings; the palace of governors in Afrasiyab, with wall paintings; the palace of the Termez governors, and others.

Cities and settlements of Uzbekistan, especially those located on the caravan routes linking western Asia with India and the far east, subsequently became centers of world trade in the 9th-10th centuries.

There are monumental buildings whose construction involved fired brick instead of adobe. Domes built on top of circular structures became the dominant form for the external shape. Pavings of fired brick are enriched with patterns. The well-known mausoleum of the Samanids, dating back to the 9th-10th centuries, truly considered a pearl of the architecture of Central Asia, is among many such monuments of architecture.

Thanks to the Great Silk Road, the cities of Movaraunnahr developed economically even further in the 11th-12th centuries, and the broader process of medieval urbanization advanced at full speed. The territory of these cities was built up with numerous complexes. Markets became places where city life was concentrated. Beside these were caravanserais (roadside inns), warehouses, baths, and mosques. Tower constructions—minarets—were erected near the mosques. In the realm of ornamental art, woodcarving, along with carving in alabaster and clay, reached extremely high levels of development. Epigraphic ornament spread greatly.

Town planning and architecture in Uzbekistan blossomed especially during the reign of Timur and the Timurids in the city of Samarkand. The cathedral mosque Bibi-hanym, the majestic mausoleum Gur-emir, the mausoleums of the necropolis Shakhi-Zinda with their sparkling surfaces of colorful glaze, were all erected during this period. Tremendous edifices were built even outside of Samarkand: Hodzha Ahmad Jassavi's architectural complex in Turkestan, the majestic palace Ak Saray and the memorial complexes in Shakhrisyabz, and numerous buildings in Herat and other cities of Central Asia.

Samarkand boasts nearly 2,750 years of history, and architectural monuments which belong to the dynasty of Timurids are on the level of importance of architectural masterpieces of ancient Egypt, China, India, Greece, and Rome. In 2001, "Samarkand—Crossroads of Cultures" was inscribed on the World Heritage List.

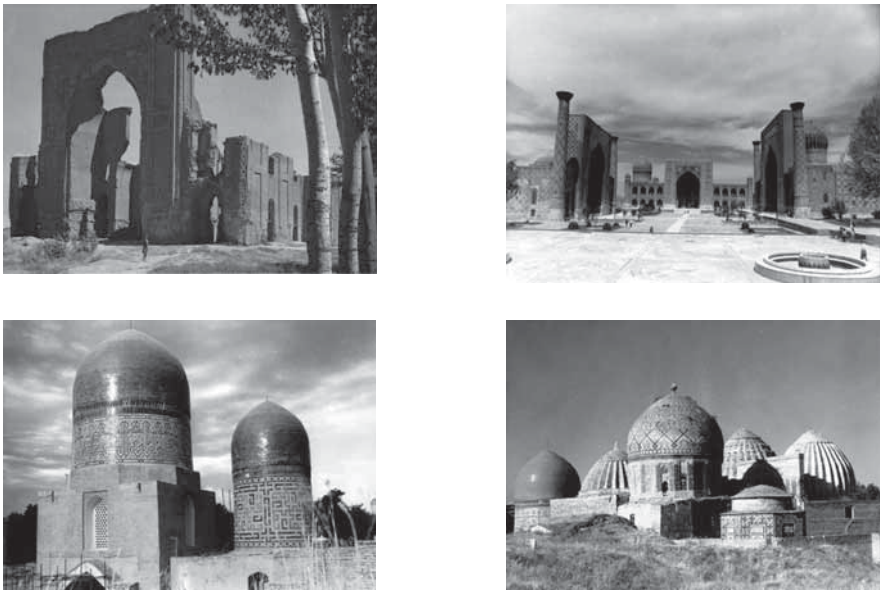
The historical and architectural monuments of Samarkand are the following.

- the ancient city of Afrosiab (6th-8th c)
- the observatory of Ulugbek (1418-1423)
- the architectural ensemble Shahi Zinda (12th-20th c)
- Hazrat Hizr mosque (mid-19th c)
- Bibi-Hanum mosque (1399-1404)

- the madrasah of Ulugbek (1417-1420)
- Sher-Dor madrasah (1619-1635/36)
- Tilya-Kori madrasah (1647-1659/60)
- the commercial dome Chorsu (end of the 18th c)
- Ruhabad mausoleum (1380)
- Ak Saray mausoleum (1470)
- Gur-Emir mausoleum (1404)
- Namozgoh mosque (17th c)
- the mausoleum of Ishrat-Khana (1964)
- Khodja Ahror ensemble (15th-20th c)
- Chulpon Ata mausoleum (1430-1440)
- the cemetery of Khoja Abdu Darun (15th-19th c)
- the memorial ensemble Imam al Buhoriy (16th-20th c)
- the memorial ensemble Matrudiy (15th-20th c)

Architectural Monuments of Samarqand

The history of Samarqand counts nearly 2750 years and architectural monuments which belong to Dynasty of Timurids has the some importance as architectural masterpieces of ancient Egypt, China, India, Greece and Rome. In 2001 "Samarqand - on crossroads of world culture" (25-sesion - Finland) was included in the list of World Cultural Heritage.



The ancient Afrosiab city, The Observatory of Ulugbek (1418-1423), Architectural Ensemble Shahi Zinda, Hazrat Hizr Mosque (The Middle of XIX c), Bibi –Hanum Mosque (1399-1404), The Madrasah of Ulugbek (1417-1420), Sher –Dor Madrasah (1619-1635/36), Tilya- Kori Madrasah (1647-1659/60), Commercial Dome Chorsu (the end of XVIII centuries), Ruhabad Mausoleum (1380), Ak-Saray Masoleum (1470), Gur –Emir Mausoleum (1404), Namozgoh Mosque (XVII), The Mausoleum of Ishrat Khan (1964), Khodja Ahror Ensemble (XV-XX c), Chulpon Ata Mausoleum (1430-1440), The Cemetery of Khoja Abdu Darun (XV-XIX c), Memorial ensemble Imam al Buhoriy (XVI-XX c) and etc. Photo from Internet

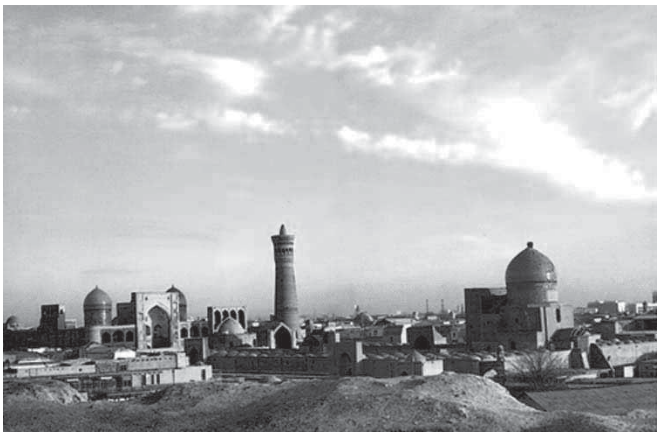
The city of Bukhara, whose name derives from the Sanskrit word for "cloister," was at times the biggest commercial center on the Silk Road. Bukhara is a "museum city" which includes more

than 140 architectural monuments of the middle ages. Such ensembles as Poi-Kalyan, Kosh Madras, the mausoleum of Ismail Samani, the Kalyan minaret, and others which were built as much as 2,300 years ago nowadays attract the attention of famous poets as Narshahi, Rudaki, Dakiki, scientists such as Avitsenna, and others who play a major role in developing Bukhara. In 1993, "The Historical Centre of Bukhara" was inscribed on the World Heritage List.

The historical and architectural monuments of Bukhara are the following.

Architectural Monuments of Bukhara

In Sanskrit Bukhara means "cloister", which sometime was the biggest commercial center on the silk road. Bukhara is "museum city", includes more than 140 architectural monuments of middle ages. Such ensembles as Poi- Kalyan, Kosh Madras, Mausoleum of Ismail Samani, Minaret Kalyan and others which were built 2300 years ago nowadays attract attention famous poets as Narshahi, Rudaki, Dakiki, scientists Avitsenna and others play, the main role in developing of Bukhara. In 1993 "The historical center of Bukhara" (17 session, Kolubia) was included in the list of world culture Heritage.



Historical and architectural monuments of BUKHARA

- *Ark (XI-XX centuries),*
- *Bola-Hauz ensemble (the beginning of XVIII-XX centuries),*
- *The Mausoleum of Ismail Samani (IX-X centuries),*
- *Chashmai –Ayub (1380 or 1384/85),*
- *Abdulla- Khan Madrasah (1596/98),*
- *Madari –Khan Madrasah (1556/57),*
- *Baland Mosque (the beginning of XVI centuries),*
- *Gaukushan Ensemble (mosque, minaret, madrasah XVI centuries),*
- *Zaynutdin Hoji Honaka (1555),*
- *Poi Kalon Ensemble (XII-XIV centuries),*
- *Labi Hauz (XVI-XVII centuries),*
- *Kukeldash Madrasah (1568/69),*
- *Nodir Divanbegi Honaka (1620),*
- *Ulugbek Madrasah (1417),*
- *Abdulaziz Khan Madrasah (1652)*

Photo from Internet

- Ark (11^{th}-20^{th} c)
- Bola-Hauz ensemble (early 18^{th}-20^{th} c)
- the mausoleum of Ismail Samani (9^{th}-10^{th} c)
- Chashmai-Ayub (1380 or 1384/85)
- Abdulla-Khan madrasah (1596/98)
- Madari-Khan madrasah (1556/57)
- Baland mosque (early 16^{th} c)
- Gaukushan ensemble (mosque, minaret, madrasah, 16^{th} c)
- Zaynutdin Hoji Honaka (1555)
- Poi Kalon ensemble (12^{th}-14^{th} c)

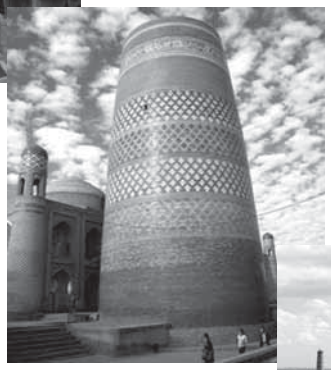
- Labi Hauz (16^{th}-17^{th} c)
- Kukeldash madrasah (1568/69)
- Nodir Divanbegi Honaka (1620)
- Ulugbek madrasah (1417)
- Abdulaziz Khan madrasah (1652)
- Bola Hauz mosque (1712)
- Sayfiddin Baharziy mausoleum (latter 13^{th}-16^{th} c)
- Buyan Kuli Khan mausoleum (latter 14^{th}, or 15^{th}-16^{th} c)
- Honaka Phazabad (1598/99)
- Chor-Minor madrasah (1807)
- the castle of Bukhara Emir Sitarai Mohi Hossa (19^{th}-20^{th} c)
- the memorial architectural complex Chor-Bakr, the burial place of the Djubayris sheikhs (1560-63)
- the memorial architectural complex of Bahauddin Nakshbandiy (16^{th}-17^{th} c)

The mystical city Khiva retained the exotic oriental form of its ancient inner town Itchan Kala, where many architectural monuments are situated. In 1990, Itchan Kala in Khiva was inscribed on the World Heritage List.

Mystical city Khiva could keep exotically shape of oriental city in ancient part of the city Ichan-Kala where are situated a lot of architectural monuments. In 1990 "Ichan - Kala" in Khiva (XIV session, Canada) was included in the of the World Cultural Heritage.

Historical and architectural monuments of Khiva:

- *Ichan –Kola,*
- *Said Bay Mosque and Madrasah (XVIII-XIX centuries),*
- *Allakulikhan Madrasah (1834/35),*
- *Kutlug Murad –inak Madrasah (1804/12),*
- *Tim and Allakulika's caravanserai (XIX c),*
- *Abdulla Khan Madrasah (1865),*
- *The Mosque and Bath – Hoses of Anush Khan (1657),*
- *Tash – Hauli (castle of Anakulihan) (1830/36),*
- *The white –Mosque (1832/42),*
- *Djuma Mosque and Minaret (1788/89),*
- *Mausoleum of Said Allautdina (XIV century),*
- *The Madrasah of Muhammad Amin Khan (185),*
- *Kalta Minor Minaret(1855),*
- *Kunya- Arc (1868/88),*
- *Tura –Murat – Tur Minoret (1888),*
- *The Madrasah of Muhammad Amir inake (1871),*
- *The Madrasah of Shirgazi Khan (1718/20).*



Architectural Monuments of Khiva

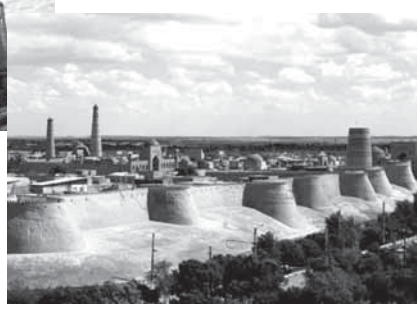


Photo from Internet

The historical and architectural monuments of Khiva are the following (in Itchan Kala).

- Said Bay mosque and madrasah (18^{th}-19^{th} c)
- Allakulikhan madrasah (1834/35)
- Kutlug Murad-Inak madrasah (1804/12)
- Tim and Allakulika's caravanserai (19^{th} c)
- Abdulla Khan madrasah (1865)
- the mosque and bath-houses of Anush Khan (1657)
- Tash-Hauli (castle of Anakulihan) (1830/36)
- the white mosque (1832/42)
- Djuma mosque and minaret (1788/89)
- the mausoleum of Said Allautdina (14^{th} century)
- the madrasah of Muhammad Amin Khan (1851/52)
- Kalta Minor minaret (1855)
- Kunya-Arc (1868/88)
- Tura-Murad-Tur minaret (1888)
- the madrasah of Muhammad Amir Inake (1871)
- the madrasah of Shirgazi Khan (1718/20)
- the mosque of Bagbanli (19^{th} c)
- the madrasah of Arabhan (1838)

When the Republic gained independence, the protection of cultural monuments was placed at the level of state policy. The "Law on the Conversation and Usage of Cultural Heritage Objects" is in force in Uzbekistan. All questions regarding their preservation, restoration, conservation, and use are regulated within the framework of this law.

According to the working laws of the Republic of Uzbekistan about the protection and use of places of cultural heritage, as of 1 January 2006 there were 7,734 places of cultural heritage in the territory of Uzbekistan registered with the state, consisting of 1,526 places of importance to the Republic as a whole, and 6,208 places of local importance.

The places of cultural heritage of importance to the Republic as a whole are as follows.

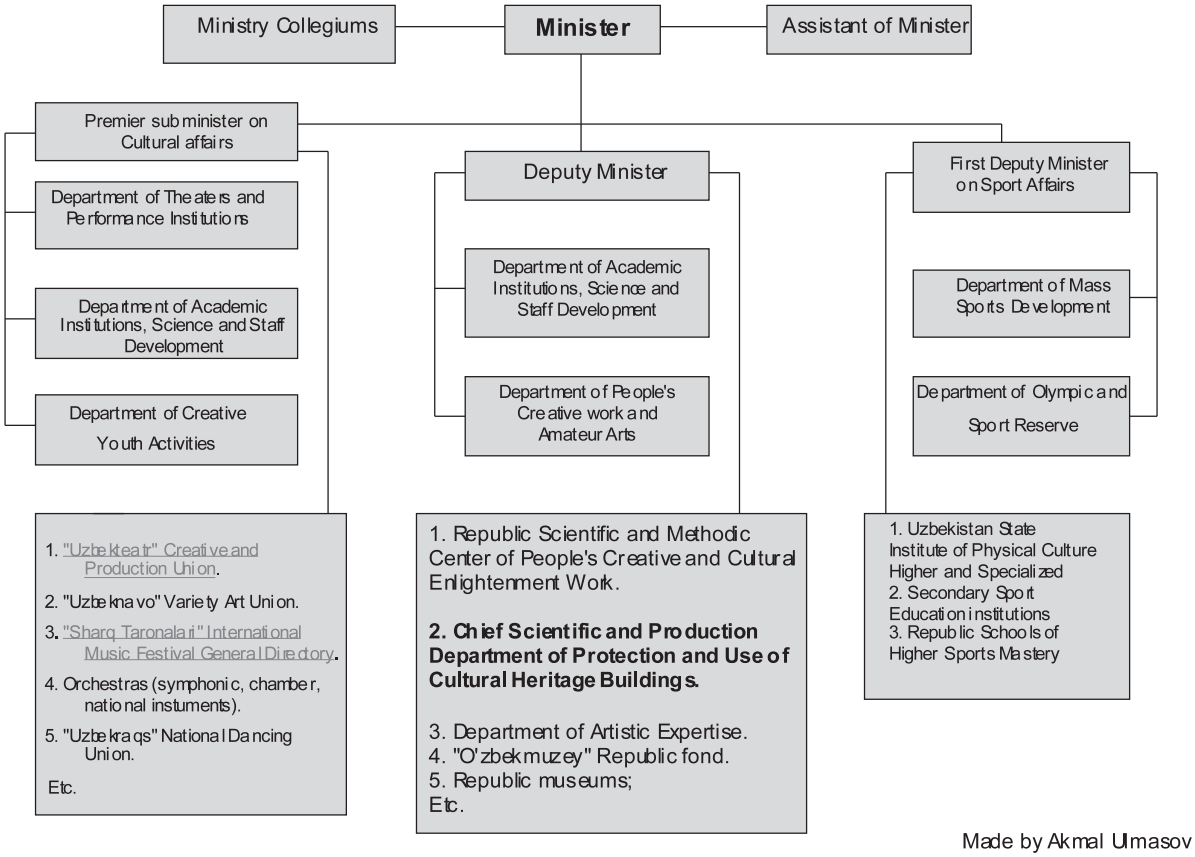
- 776 monuments of archeology
- 579 monuments of architecture
- 19 monuments of historical architecture
- 152 monuments of art and sculpture

The places of cultural heritage of local importance are as follows.

- 3,371 monuments of archeology
- 1,790 monuments of architecture
- 171 monuments of historical architecture
- 876 monuments of art and sculpture

How is this tangible cultural heritage being managed? The Cabinet Ministry of the Republic of Uzbekistan, the Ministry of Cultural and Sports Affairs, the Chief Board of Archives under the Cabinet Ministry, and other local organs of management are the official organs regulating the protection and use of places of cultural heritages according to the laws of the Republic.

The Structure of the Ministry of Cultural and Sports Affairs Administration



Made by Akmal Ulmasov

The duties of the Ministry of Culture and Sports Affairs of the Uzbekistan Republic are as follows.

- realize state control in the observance of legislation on the protection and use of places of cultural heritages
- take part in the planning and realization of state agenda on protection, support, and

use of places of cultural heritages

- realize state programs on studying, conservation, restoration
- provide for the classification, registration, protection, publicizing, and also use of places of cultural heritage
- conduct state surveys of places of cultural heritage
- organize and hold historical cultural experiments with places of cultural heritage
- fulfill other tasks according to the law

Organs of local government identify and register places of cultural heritage within their districts of jurisdiction, supervise their protection and use, execute legislation regarding the protection and use of places of cultural heritage, carry out the activities of bringing in local legislatures and public organizations into the programs of protection, spread information about places of cultural heritage, and perform various other actions connected with cultural heritage.

As specified by law, the Ministry of Culture and Sports Affairs conducts its supervision of protection and use of places of cultural heritage through the Chief Scientific Board, and also through the Ministry of Culture and Sports Affairs of the Republic of Karakalpakstan which maintains territorial control over cultural and sports affairs, and through inspectional departments on the protection and use of cultural heritage, departments of cultural enlightenment affairs and museums, the state Historical Museum Park of Itchan Kala in Khiva, the Samarkand History and Culture Museum, and the Bukhara State Architectural Art Museum-Preserve.

There is an advanced system for the preservation of monuments in Uzbekistan in the form of the General Research and Production Department of the Ministry of Culture and Sports Affairs, which includes in its structure a scientific research and project institute (Tamirshunoslik), eleven research and production departments and sites, including an art restoration department (Kadrijat-tamir) which carries out restoration and preservation of the unique art works on the monuments of architecture.

The main tasks of the Chief Board regarding places of cultural heritage are as follows.

- exercise state control over the execution of laws for the protection and use of places of cultural heritage by the appropriate agencies
- participate in developing state agenda in the fields of protection, conservation, publicizing, and use of places of cultural heritage
- realize state agenda for the study, conservation, and restoration of places of cultural heritage, and also for their modernization
- provide for the classification, registration, protection, publicizing, and use of places of cultural heritage
- coordinate activities on protection and use of various organs

- conduct state surveys at places of cultural heritage
- organize and hold investigations by historical cultural experts at places of cultural heritage
- provide for the execution of the state plans for fast-tracking memorials and statues
- control activities regarding historic, art, and architectural holdings of museums, including the organization of art exhibitions
- train and raise the qualifications of specialists and workers
- execute other tasks according to law

State inspections are in operation regarding control over the technical condition of monuments of architecture, the correctness of their maintenance, restoration, and repair work, in all regions of the Republic.

The fact that up to the present, of the six places of cultural heritage from Central Asia included on the World Heritage List, five are situated in the territory of Uzbekistan should be emphasized. There are ten cities in Uzbekistan with high concentrations of monuments of architecture that are included in the list of historical cities, and among them are Samarkand, Bukhara, Khiva, Shakhrisyabz, Tashkent, Kokand, and others.

The decision by the government of the Republic to make Itchan Kala, the inner town of the city of Khiva, a state architectural preserve was an important event in protection of monuments and their environment. The territory of the reserve has been determined within the limits of existing fortifications, including all complexes and ensembles of monuments and the constructions representing historical, art, and architectural value. Making use of this positive experience in Khiva, the historically developed centers of the cities of Bukhara and Samarkand were declared as historical architectural preserves. For example, today the territory of the Bukhara preserve comprises about 200 hectares, where there are 123 monuments of architecture. Among them, more than 20 monuments are used for museum expositions, more than 50 are on open display to tourists, and about 50 monuments are used as creative workshops of national masters and for other purposes. At present preparatory work for the creation of a reserve in the historical part of the city of Shakhrisyabz is being conducted.

Uzbekistan has become a full member of the international organization UNESCO. The monuments located in the Itchan Kala preserve in Khiva (1990), those in the historical center of Bukhara (1993), monuments of architecture of the epoch of Timur and the Timurids in the city of Shakhrisyabz (2000), and monuments of the historical city center of Samarkand (2001) are included on the World Heritage List. At present, the following thirteen outstanding monuments have been submitted to World Heritage Committee following their tentative listing: the mausoleums of Ak Astana-baba, of Arab-ata, of Ishrathan, of Mir-Sayid Bakhrom, the memorial complexes of Bahoutdin, Chor-Bakr, Sheikh Mukhtar-Vali, Khakim at-Termiziy, and also Rabati Malik, the *jaajjfaret* of Dzharkurgan and Vabkent, the palace Kyrk Kyz, and the dam Hon bandi.

The preservation and restoration of separate monuments on the basis of detailed research work was followed by restoration of entire architectural ensembles and the historically developed centers of ancient cities.

Restoration and reconstruction works in Architectural Monuments

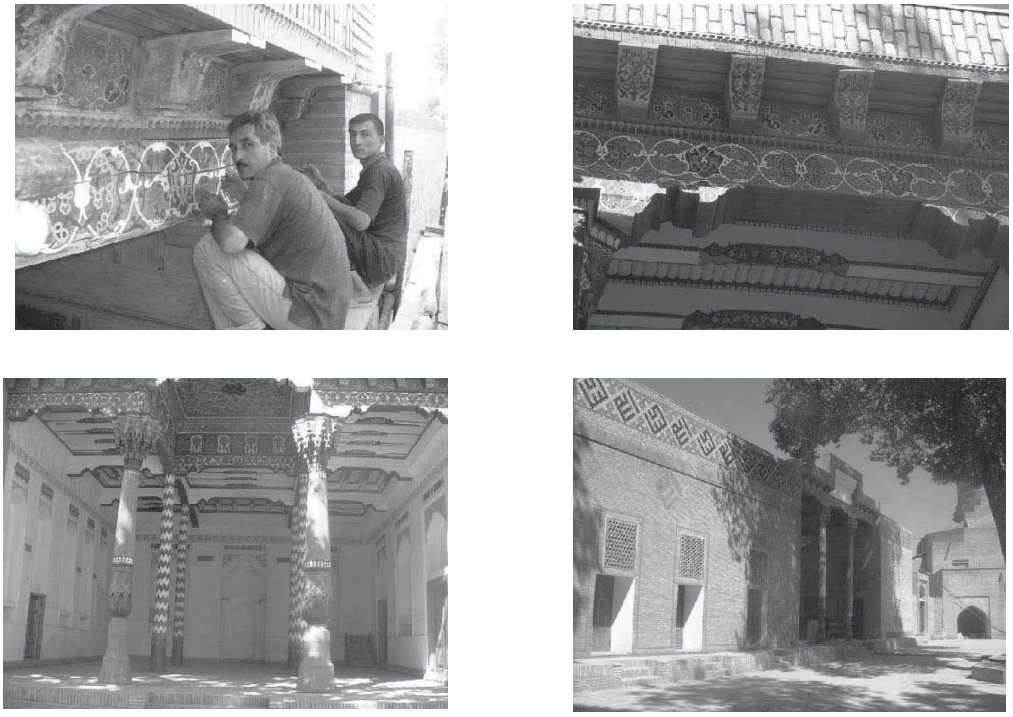


Photo from Internet

Owing to these actions, the following monuments have been preserved and are accessible to tourists: the ensemble Registan; the imperial necropolis Shakhi-Zinda; the architectural complex Bibi-Khanym; the ensemble mausoleum of Amir Timur; the complex Ruhabad; the memorial of Imam Buhari in Samarkand; a minaret and a mosque of Kaljan; the madrasah Mir-arab; the ensemble Ljabi-hauz; the madrasahs of Ulugbek and Abdulaziz Khan; the trading domes, country ensemble Sitora-i-Mohi-hosa and the complex of Bahauddin in Bukhara; all architectural monuments of Itchan Kala in Khiva, including Kuaja Ark, the madrasah and mosque of Muhammad Amin Khan, a minaret of the Islam Hodza, the palace Tash Hauli, Dzhuma mosque; the palace of Khudayar Khan and necropolis Dakhma-I-Shokhon in Kokand; in Shakhrisyabz, the ensembles Doras Saodat and Dorus Tilovat, and Timur's famous palace Ak Saray; the architectural complex of Al Khakim At-Termizi, the Sultan Saodat ensemble, and the Kokildora mausoleum Khanaka in Termez; and others.

In addition, it has become possible to develop plans in which monuments of history and culture are the dominant objects not only of ancient cities, but also of modern settlements. In connection with rapid

growth and urbanization, it has become necessary to develop detailed projects for the layout of the most ancient cities of Uzbekistan. Such projects have been drawn up for Bukhara, Samarkand, Khiva, Shahrisjabz, and Tashkent; in these plans the borders of security zones, zones for adjustable building, for preservation of the landscape, etc., are precisely determined. Similar projects are planned for other cities of Uzbekistan, where there are also concentrations of monuments. All this has become possible owing to the creative actions of many scientific experts and national leaders.

There are more than 2,700 monuments of archeology in the territory of Uzbekistan. They are no less valuable than the architectural ones. They include the Sogdian capital Afrasiyab, the Kushan capital Dalverzin, the ancient settlement sites of Halchajan, Nesef, and Kanka, the Buddhist temples Kara Tepa and Fayaz Tepa, and many others of various kinds, well-known to the world and to experts of art and history for their surprising and invaluable archeological finds. Unfortunately, the preservation of sun-dried brick constructions remains problematic. For this reason, and in this area, research and experimental work are being carried out, but positive practical results have not yet been achieved.

Archaeological Monuments

Zurmala tower.

Kirk-Kiz.

Photo from Internet

Contacts with UNESCO are maintained with the assistance of the Republic's National Commission for UNESCO. The project for preserving and converting to a museum the Buddhist temple Fayaz Tepa, in the Surkhandarya area, is being carried out through this relationship, in the same manner that practical reconstruction was realized at the archeological sites of Kampir Tepa, Kara Tepa, etc. The Fayaz Tepa monument is located near Termez, and appears to be part of a Greco-Bactrian port city.

Reconstruction of Archaeological Monuments. Kampirtepa and Fayazteoa

Kampirtepa. Fortification wall.

Fayaztepa. Part A..

Kampirtepa. Fortification wall.

Museum and Restoration centre.

Photo by Ilyasov J., Ulmasov A.

Besides archaeological and architectural monuments, there is a large amount of movable tangible cultural heritage as archaeological artifacts and finds in the museums of Uzbekistan. There are currently more than ten major museums, and a total of sixty different museums and collections altogether in Uzbekistan. But most museums have no laboratory or qualified specialists for restoration.

Currently, Uzbekistan is in the process training specialists for cultural heritage preservation work. In 1999, for example, an applied arts program in monument restoration opened at the National Institute of Fine Arts and Design named after K. Bekhzad (NIFAD), in the Academy of Art of Uzbekistan. The author of this report graduated in this specialty and is now teaching at the institute. Within a short time, students were able to take part archaeological expeditions, and take training courses in “Cultural Caravanserai” by Ikuo Hiroyma. They study how to draw, how to restore ceramics and other artifacts, and broaden their knowledge.

The Republic has problems regarding methods of preservation and restoration of monuments, the application of certain building materials, the control of erosion by subsoil water, techniques of carrying out complex research on the designs of monuments, development and application to ancient building of facing materials, glaze, etc.

Process of study in Restoration Laboratory. Students of Institute of Bekhzad spent practical work in FASRI and Archaeological expeditions.

Dalvarzintepa - 2007

Institute FASRI

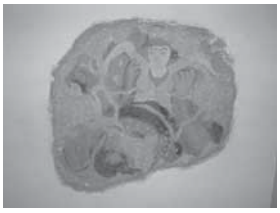
Institute FASRI

Dalvarzintepa - 2007

Fayaztepa - 2005

Photo by Eiji Urasuji

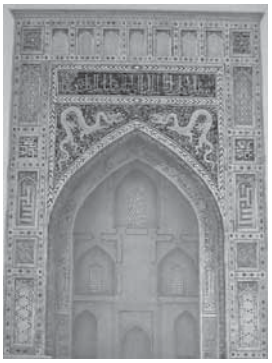
Diplomas and class works of students NIFAD



By Akmal Ulmasov

By Akmal Ulmasov

By Pegushina Yulya



By NIFAD

By NIFAD

Photo by Akmal Ulmasov

We have achieved some positive results, but there are many problems which we need to face in the near future. I believe that to improve the situation for protecting cultural heritage we need to realize following:

- educate local people about the need to protect archaeological sites
- take school students of all levels up to college on excursions to learn the about cultural heritage
- spread information on the importance of cultural heritage through the mass media
- encourage specialists to learn new techniques and knowledge in foreign countries with high levels of technology and materials for restoration work
- organize a "Research Center for Restoration" (RCR) in Uzbekistan with international assistance, bringing in new techniques, technology, and materials for conservation of the cultural heritage
- provide training at the RCR for curators and students to obtain this know-how
- promote communication among museums and other organizations for the restoration of museum artifacts, etc.

Normally our specialists use traditional methods and materials for restoration and conservation. Currently, however, we are seeking out new resources from abroad, because we need to find modern ways for restoring and repairing damage to the following types of items.

- unfired clay art objects (as sculpture and etc.)
- polychromatic murals (wall paintings)
- metal objects (iron, bronze, copper, etc.)
- historical manuscripts on paper and animal skin
- wooden structures and wooden art objects

In conclusion, I would like to express my thanks to the ACCU and other organizations for this invitation to receive training. Programs like this will help improve our skills and promote cooperation between countries. For such work, the assistance of international organizations is necessary. Because no matter where monuments are located, they represent global cultural heritage that we must protect, preserve, and pass on to future generations.

My professional affiliations and activities:

a) Fine Arts Scientific Research Institute (FASRI)
   - take part in archaeological work (restoration, conservation, drawing archaeological

artifacts)

- assist the conduct of conferences, seminars, defenses, and other administrative tasks
- gather weekly information about the Institute and upload it to the website of the Academy of Arts of Uzbekistan
- prepare items for exhibitions (cleaning, packing, installing)

b) National Institute of Fine Arts and Design named after K. Bekhzad (NIFAD)

- teach students in the program on restoration of archaeological materials about methods of restoration and the drawing of archaeological artifacts
- organize student participation on expeditions, in training courses in Cultural Caravanserai by Ikuo Hiroyma, etc.

c) Post-graduate academic work in FASRI.

- complete my PhD dissertation, titled "Architectural decors of South Uzbekistan in the Kushan epoch (genesis, evolution and problems of reconstruction)," with the aim of defending and receiving the degree within three years
- collect materials for the dissertation from libraries, archives, museums, collections, etc.
- write reports related to the dissertation subject
- take part in conferences and seminars
- take exams in philosophy, English, computer science, etc.

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Country Report

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The State Museum of the History of Uzbekistan
Academy of Sciences of Uzbekistan

Historical Heritage of Uzbekistan

Uzbekistan is a country that is blessed with rich cultural and historical heritage. Uzbek cities such as Tashkent, Samarkand, Bukhara, Khiva and Termez are known all over the world. These cities are said to be outdoor museums of historical architectural structures. The architectural ensemble of Registan Plaza in Samarkand (Ulugbek Medrese, Sherdor Medrese and Tillia-kori Medrese) is world famous. Kalian Minaret of Bukhara, Ark, Ichankala, the inner castle of Khiva, and complex of Kyr-kyz in Termez are also famous.

Uzbek archaeological sites have historical significance that is no less important than these. There are currently over 1,300 such sites. The oldest site in Uzbekistan is the Sel'ungur cave dwelling in the Fergana Valley. Remains of primitive humans, including seven teeth and a piece of humerus, were discovered there. According to the data obtained in the laboratory of the Institute of Nuclear Physics, Academy of Sciences of Uzbekistan, the bones are estimated to be 1.5 million years old.

The Kul'bulak cave dwelling in the state of Tashkent is located in a Stone Age dwelling site within Uzbekistan. Bones of ancient human beings were found there as well. According to reports of experts, they belong to a type of primitive human that was previously unknown. These primitive humans are positioned somewhere between Neanderthal and Cro-Magnon man.

Burials of Neanderthals were discovered in the Teshik-tash Cavern in Surkhandar' State of Uzbekistan. Here, the skeletal remains of a youth of eight or nine years surrounded by ram horns were discovered. Many sites of ancient tools and Neolithic sites are recorded in Uzbekistan. To mention a few, the sites include Zamanbaba, Kiuzaligyr and Chust.

A fundamental turning point was produced by socioeconomic growth of the Bronze Age, ushering in urban culture inside Uzbekistan. The Sapalli culture is spread across the southern states of Uzbekistan. This is a regional variety of known as "Bactria and Margiana Archaeological Complex" or BMAC. This culture spread across Turkmenistan, Afghanistan and part of Uzbekistan. Characteristic of this culture is the existence of developed agricultural and crude urban culture. Many sites of this period (20th to 17th centuries B.C.) have been discovered by archeologists. These include the Togolok 1 and Togolok 21 sites, Gonur, Dashly 1-3, Sapalli and Dzharkutan.

From the 6th to 5th centuries BC, the region of Central Asia was under the control of the Achaemenid Empire of Persia. The founder of this empire, Cyrus the Great (559 – 529 B.C.), conducted a mighty expedition against the Massagetai nomads. Another Persian Emperor, Darius I (522 – 486 B.C.), was the true founder of the Achaemenid Empire, and he conducted an expedition against the Saka, who were Iranian nomads, and as a result, forced all ethnic groups of Central Asia into submission. This incident can be seen in the expression of the relief decorating the stairs of Darius' palace in Persepolis (one of the three capitals of the Persian nation). The name of the Saka monarch, Skunha, is inscribed in the Naqsh-e Rustam area. The monarch is represented as kneeling before Darius. Researchers believe this symbolizes the victory of the Persian emperor.

After conquering the Persian ethnic groups of Central Asia, all of them entered three satrapies. The satrapy is an administrative/regional unit of the Achaemenid Empire. According to the inscription of the Achaemenid emperor, Bactrians, Sogdians, Khorezmians, Parthians, Sakas Tigrakhauda, Sakas Haumavarka and Sakas Taradarya resided in Central Asia at that time. The ethnic groups of Central Asia annually paid a total of approximately one ton of tax in silver. There are many known archaeological sites of this period in Uzbekistan. For example, there are over thirty recorded sites of the Achaemenid Empire Period in Surkhandaryo State alone.

It is recorded that, following the Achaemenid Empire Period, ethnic groups of Central Asia split not only based upon administrative/regional principles, but upon historical/cultural principles as well. In ancient times (Central Asian Classical Period: 4th century B.C. to 4th century A.D.), present day Uzbekistan contained historical/cultural areas of Sogdiana, Bactria, Khorezm, Chach, Ustrushana and Davan'.

Sogdiana: Historical/cultural area of the Zaravshan River (Central Sogd and West Sogd) and Kashkadar'ia River basin (South Sogd). The name is mentioned as "Gava Suguda" in the Avesta (Zoroastrian scripture). The administrative/political center was located in Marakand. This is the equivalent of the urban site Afrasiab in the area now known as Samarkand City (Total area of the site is 200 hectares). According to data of archeologists, people began carrying out activities at this site around the turn of the 5th and 6th century B.C. The ruins of the protective wall that once surrounded the city originate from this period. The ruins of the city of Koktepa, the second capital of Sogdiana, are located 35 kilometers from the ruins of Afrasiab. This place is mentioned in Greek and Roman historical data in relation to the expeditions of Alexander the Great. The ruins of the city of Erkurgan are located in the Kashkadar'ia River basin. The expanse is approximately 130 hectares. It is significant in that was the third ancient city of Sogdiana.

Bactria (Bactriana): In Greco-Roman historical records, Bactria was called "the country of thousands of cities" and "the jewel of Ariana" (the area in which ancient Iranian peoples resided was called "Ariana"). This fertile region was positioned in the upper and middle reaches of the Amu Darya River. This extended from the Piandzh headwaters (Tajikistan) up to the great curve near the area currently known as Kelif (Turkmenistan). The southern border of Bactria was the Hindu Kush mountains (Afghanistan) and the northern border was the

Gissar mountains (Uzbekistan). The administrative and political center of Bactria was the city of Baktry (currently Balkh, Afghanistan) 80 kilometers from the Amu Darya River. The flow of the Amu Darya River separates Bactria into two parts, north and south. North Bactria consisted of what is now known as Surkhandar' state of present day Uzbekistan, Kurgan-Tiubin state of Tajikistan, and Turkmenistan up to the middle reaches of the Amu Darya River. Since ancient times, the region has been dotted with settlements along the Sherabaddar'ia, Surkhandar'ia, Kafirnigan and Vakhsh valleys. Under the rule of the Achaemenid Dynasty of the ancient Persian Empire (530 - 330 B.C.), due to special circumstances of Bactria, it was occasionally ruled by close relatives of the emperor. Davani is the Farghāna valley (Uzbekistan, Tajikistan and part of Kyrgyzstan. The area is a basin surrounded in three directions by the lateral veins of the Pamir/Arai mountains and the Tian Shan mountains.

Khorezm: Historical and cultural region of the Amu Darya River and Syr Darya River lower reaches. Many cultural sites worthy of special mention such as Toprakkala, Kalallygur and Kiuzeligyr have been found here.

Here ends the brief overview of ancient history of Uzbekistan. In conclusion, we can confirm that both cultures of settled agriculture and nomadic ethic groups have existed in the area of Uzbekistan since ancient times. Connected to other countries in the region and all of Eurasia by the Silk Road, the area produced a unique local civilization. The unique location at the center (heart) of Asia facilitated reception of countless cultural influences and thoughts. In various ages, Zoroastrianism, Buddhism, Christianity, Manichaeism and Islam flourished here. The cultural transformation process of doctrine based on local fundamentals already existing at that time can be observed. Sociability and tolerance were innate qualities of the local inhabitants. It is therefore no surprise that the local inhabitants themselves served as intermediaries for the massive caravan trade that flourished on the Silk Road. It is widely known that the Sogdians formed their own companies way before European merchants and founded trading posts all across the Silk Road, from Samarkand to Nara.

The entry of the Achaemenid Empire that was an ancient great empire of Central Asia, the Empire of Alexander the Great, the Seleucid Empire and Kushan Empire (under the great sacrifice of conquest along the process of conquest) promoted abundant positive socioeconomic and cultural growth of local ethnic groups in Central Asia. At the same time, after the passage of a certain amount of time, the various ethnic groups of Central Asia received progressive cultural thought and ultimately secured the right to cultural and traditional identity.

Ⅳ. Participants' Final Reports

Final Report

Bakhriddin BOLIYEV

Three participants (B. Boliyev, researcher, Institute of Archaeology, Academy of Sciences of Uzbekistan, Samarkand; A. Ulmasov, junior scientist, Fine Arts Scientific Research Institute, Academy of Arts of Uzbekistan; A. Gorin, junior research assistant, State Museum of History of Uzbekistan, Academy of Sciences of Uzbekistan, Tashkent) took part in the training course to improve their technical skills under the theme of "Training Course on Cultural Heritage Protection in Asia-Pacific Region 2008 (Individual Course)" for a period of 34 days from July 16 to August 18, 2008.

Sponsorship

The course is jointly organized by *Bunkacho* (Agency for Cultural Affairs, Japan); Asia/Pacific Cultural Centre for UNESCO (ACCU); and National Institutes for Cultural Heritage, Nara National Research Institute for Cultural Properties.

Objectives of the training course

The main objective of training is to introduce the latest equipment and its operation principles for conservation of metal objects; the latest cleaning methods, restoration and storage techniques for metal artefacts are also introduced.

Training program:

- Introduction to Conservation Science and its Treatment
- Microenvironment and Environmental Control Systems in Museum
- Observation and Documentation of Archaeological Artefacts
- Cleaning Methods of Metal Objects
- Reinforcement Treatment for Artefacts
- Desalination and Stabilization of Metal Objects
- Treatment for Filling and Shaping
- Summary of Conservation Treatment and Handing of Equipments (NNRICP)
- Registration System for Artefacts Management
- Methodology for Museum Display
- Practical Training in Museum

Institutions conducting lectures and practical training:

- Nara National Research Institute for Cultural Properties
- Archaeological Institutes of Kashihara, Nara Prefecture
- MIHO Museum
- OKAYAMA Orient Museum

- Ancient Orient Museum
- Tokyo National Museum

Equipment used at Nara National Research Institute for Cultural Properties for which explanation of operation principles was received:

- Computed radiography equipment
- X-ray photography equipment
- Fluorescent X-ray analysis equipment
- X-ray diffraction analysis equipment
- Stereoscopic microscope with digital imaging equipment
- Air-brasive unit for metal surface cleaning using nitrogen gas and glass particles
- Decompression tank for metal preservation treatment by benzo-triazole (BTA) and acrylic resin B72 liquid
- Compact grinder and ultrasonic polisher for physically cleaning metal
- Electronic scale

Organic substances used for practical training

Ethylene-diamine tetra-acetic acid (EDTA), superabsorbent polymer, benzo-triazole (BTA), acrylic resin B72, toluene, acetone, ethanol, methanol

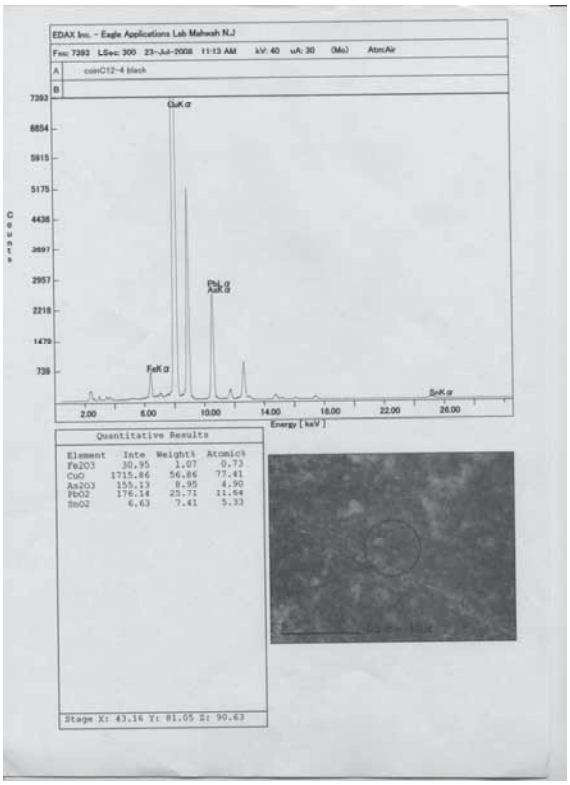
1. Lectures and practical training conducted at Nara National Research Institute for Cultural Properties

■ Naked eye observation of unearthed artefacts

When digging, metal products (copper, brass, iron, etc.) are unearthed together with ceramics and tiles. The unearthed artefacts are observed by the naked eye. Condition and appearance are observed.

■ Fluorescent X-ray analysis

After naked eye observation, the chemical composition of the metal was analyzed by a fluorescent X-ray spectrometer. Various locations (rusted, portions, slightly rusted portions and portions not affected by rust) were selected and the chemical composition of the metal was studied (using eighth century Japanese coins). Analysis revealed that the chemical composition of the metal fundamentally consisted of five elements: copper, lead, tin, arsenic and iron. Fluorescent X-ray analysis has established the chemical compositions by studying the particular type of X-ray produced by irradiating the substance with X-rays.



Fluorescent X-ray analysis results

■ X-ray photography analysis

X-ray photography analysis provides information concerning the condition of metal (cracking, holes, etc.) that cannot be seen by the naked eye. We took X-ray photographs of coins. Time, voltage, current and film sensitivity play an important role in the process. Current, time and voltage is selected respectively according to thickness and chemical composition of the metal. Three types of film, each with a different sensitivity were used (if sensitivity of No. 100 film is regarded as 100 percent, then No. 80 would be 55 percent and FR would be 20 percent). With this experiment, we decided to apply the conditions of 2 hours and 110 kV to low sensitivity film for photographing the target objects (coins).

■ Physical/chemical cleaning of metal

When physically cleaning metal, first we wash away dirt adhering to the surface with ethanol using a brush. More persistent dirt is removed with a scalpel while viewing with a microscope. A compact grinder and ultrasonic polisher are used to remove the layer that is difficult to remove from the surface.

Metal cleaned by a physical method may also by chemically cleaned. When chemically cleaning metal, a 1 percent ethylenediamine tetraacetic acid (EDTA) aqueous solution is used. Superabsorbent polymer is added until soft agglomerate develops in the EDTA aqueous solution. When the agglomerate is applied to the surface of the metal, the agglomerate soon begins to melt away rust. The process is repeated until the layer of rust is dissolved. The superabsorbent polymer agglomerate is subsequently washed away with purified water, and the metal is immersed in a vessel containing methyl alcohol for a period of 24 hours.

■ **Demineralization treatment (stabilization) and reinforcement**

A 2 percent benzo-triazole (BTA) solution is used for demineralization treatment of metal. The BTA solution further stabilizes metal. Both reversible and irreversible resins were used for practical training. Reversible resins possess plasticity. The cleaned coins are placed in a vessel containing BTA solution and then placed inside a depressurized case. The coins are subsequently washed with methyl alcohol and dried. Metal is not always in a stable state. Metal rusts for various reasons. If the metal does not receive demineralization treatment, the oxidation process continues. Oxidation is weakened after treatment and the metal becomes more stable.

B72 acrylic resin (reversible) is dissolved by organic solvents such as acetone, toluene and xylene. The coins are coated with a 5 percent B72 acrylic resin solution and placed in a depressurized case. If only the surface of the coins is to be treated, acetone is used as a solvent. The degree of penetration of the resin depends on the volatility of the solvent. Acetone is more volatile than other solvents. In order to penetrate the resin sufficiently, the resin is dissolved with solvents with lower volatility such as toluene or xylene. Acetone is subsequently added to the solution at a ratio of 1:1. After drying, a thin transparent layer of resin forms on the surface of the coins. The layer is carefully removed using acetone. Acetone is slowly and carefully brushed on the surface so as not to penetrate deeply.

■ **Packing and storage/preservation of artefacts**

Special 3-ply polyethylene bags are used for packing metal products. Chemicals to absorb humidity, oxygen and other corrosive gases are placed in the special bags together with the artefacts along with an oxygen indicator. If the indicator turns red, it indicates there is no oxygen present. By doing so, the metal can be maintained in a state of no more than 10 percent humidity and no more than 0.1 percent oxygen concentration.

2. Kashihara Archeological Institute, Nara Prefecture

Archeological researchers of the Kashihara Archeological Institute are involved in excavations at several sites.

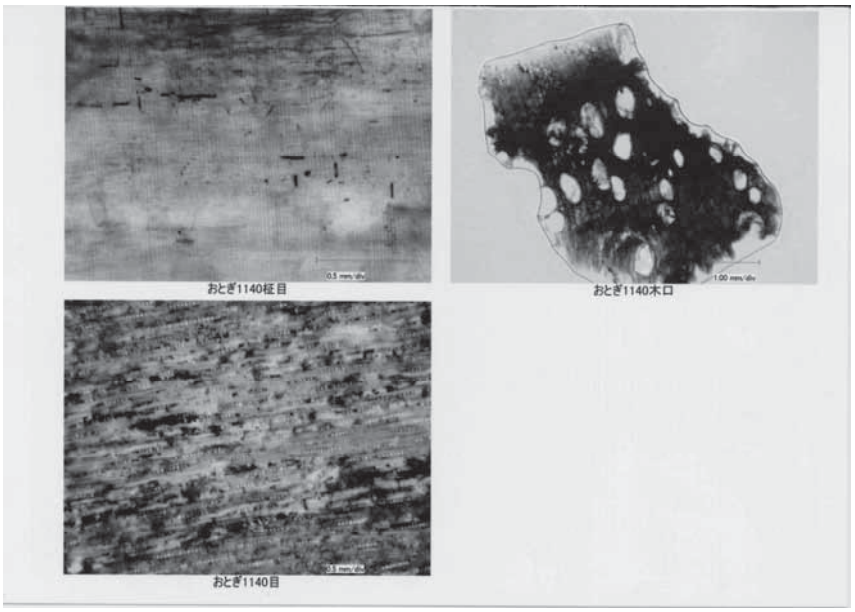
Excavation 1: The excavation site is divided into small grids. The site is generally covered in black clay, and light gray spots of various sizes can be seen in each respective grid section. The person in charge of the excavation believes the spots may be the footprints of living creatures remained in the rice paddy at the time. Former river channels, *shigarami* (weirs for regulating water level in the channel) and grave-sites have been found (from *Jomon* Period to *Nara* Period).

Excavation 2: The excavation site is divided into small grids. The person in charge of the excavation believes there may be three stratum surfaces (*Jomon* Period, *Yayoi* Period and *Nara* Period). The remains of fire hearth used during two periods were found. Post holes from various periods were also found.

The Archeological Institute of Kashihara has annually conducted excavations at 40 to 50 sites in Nara Prefecture. An exhibition reporting excavation survey is annually held at the annex museum of the Archeological Institute of Kashihara. All excavated artefacts are exhibited by period in the exhibition rooms of the museum, and are protected in glass cases. All conditions are arranged for exhibition and

visitors at the museum; the artefacts are stored in the museum vault under constant temperature and humidity. Metal products are placed in polyethylene bags together with substances to absorb oxygen and humidity (RP system). Wooden products are kept immersed in a 1 percent formalin solution in the winter and 1.5 percent in the summer.

Wooden products were analyzed in the conservation science wing of the Institute in practical training session. Pieces of artefacts in three directions (horizontal, vertical and tangential) were sampled and analyzed. Analysis revealed the tree species.



Microscope photographs of sampled wood pieces

The wooden products and copper mirror replicas were measured by using a 3-dimensional digitizer. Because artefacts always have reliefs that cannot be seen or which may be easily overlooked, the objective of such measurement is to detect such reliefs and patterns with the aid of this equipment.

3. The MIHO Museum is located about 50 kilometers from Nara City. The museum has also come to be known as the "museum with original exhibition items only" or the "parallel universe museum." The location, building design and valuable collections of the museum are worthy of being called so. A special exhibition of originals of the Achaemenid Empire Period (Iran) was displayed in the exhibition rooms. Some exhibitions were displayed as if they were suspended in midair. The museum has just published the catalog to celebrate its tenth anniversary.

4. Okayama Orient Museum: A lecture on "Traditional Technologies of Uzbekistan" by Ms Makiko Tsumura was held at the art museum. Local residents earnestly listened to the lecture and the lecturer talked about general information concerning Uzbekistan and its traditional crafts. The lecturer showed the audience slides and showed atlas and s*uzani* (antique tribal textiles), *tyubetevka* (ethnic women's caps), and special needlecraft scissors. The presentation aroused the interest of the audience, who asked many

questions about the things they were interested in.

Four lectures were held on the next day:

- "Current Archeological Studies in Uzbekistan–Primarily on the Study of the Japanese Team" (Mr Hiroaki Furusho): This lecture was for the general public audience. Photographs of artefacts and slides of archeologists working at the sites were introduced.
- "Samarkand – the First Capital of Uzbekistan" (B. Boliyev) concerns the history of 14th to 17th century in Samarkand and the ancient historical site.
- "Buddhist Remains in Uzbekistan" (A. Ulmasov) concerns Buddhist remains in southern Uzbekistan and artefacts unearthed by archeological excavations.
- "Ancient Ferry of Khanpur- tepa - Oxus Amu-Dar'ya Coast" (A.N. Gorin) was also the theme of archeological study and coins unearthed by excavation.

5. The Ancient Orient Museum (Tokyo) is approaching its 30th anniversary and held the special exhibition "Prof. Sakuji Yoshimura's Waseda University Excavation, 40-year Exhibition" in its exhibition room. The exhibition items told of the culture and lifestyle of ancient Egypt. We also learned how to create and manage the museum collection database. Using Japanese applications, the target items are scanned and the data is input in certain fields (period, site where unearthed, date unearthed, size, storage location, number). Being explained how to actually enter the data on a computer by Ms Makiko Tsumura, participants scanned the front and back sides of coins and input the data. Ms Saeko Miyashita introduced ancient games while showing the reproduction of a game board unearthed by archeological survey. The game was called "*Sugoroku*" (Parcheesi) in Japanese, none of which remains today, but Ms. Miyashita explained how they were played in ancient times based on unearthed materials. Ms Keiko Ishida explained the brief history of seals to us. The first seals appeared in Mesopotamia about 6000 B.C. Then cylinder-shaped seals appeared about 3000 B.C. Duplicates of ancient cylinder seals and patterns of coins were produced by using special German clay. The clay was first softened, and then the cylinder seal was rolled once on the surface of the clay board. The unnecessary border and duplicated pattern were cut away with a knife. The duplicate was then dried (baked) for about 20 minutes at 120 degrees.

6. The Tokyo National Museum plays a central role in Japan. Founded in 1872, the current Main Gallery was reconstructed and reopened seventy years ago. More than a million people visit the museum annually. The services offered at the museum are of an extremely high level even by international standards. The exhibition rooms are equipped with the latest facilities. Temperature and humidity are controlled for the articles on display; artefacts are protected from factors that could possible damage them such as humidity, ultraviolet radiation and earthquake. They have held exhibitions in Moscow, New Zealand, Germany and Canada. I believe that holding exhibitions is good for mutual international understanding, such as Japan holding exhibitions in foreign countries or exhibiting the collections of foreign museums in Japan. The objectives/themes of Japanese museums are to safeguard to pass on cultural heritage to the next generations, to develop Japanese culture, and to disseminate/expose Japanese culture to the world.

7. Soka University: The seminar, titled "Excavation Study of Uzbekistan, Primarily on Dalverzin-tepa" was held at Soka University.

8. Conclusion

Through lectures and practical training, we learned about the latest equipment for studying artefacts; how to clean metal products (physically and chemically); and how to store/preserve them. Using these methods, we determined the chemical composition of artefacts; we also took X-ray photographs; cleaned metal products (coins) in the Japanese way; and provided them with stabilization treatment for storage/preservation in the practical training session. We visited museums in Japan and learned their attitude toward the protection of cultural heritage. Each artefact in almost all museums we visited, was displayed so as to be easily viewed by visitors, and being protected from all potential causes of various damage. I understood that the primary objectives of Japanese archaeologists and curators are to preserve valuable cultural heritage; to develop the Japanese culture; and to hand on it to the younger generations.

Final Report

Akmal ULMASOV

16 July: Visit to Cultural Heritage Protection Cooperation Office, Asia/Pacific Cultural Centre for UNESCO

■ **Official visit to ACCU Nara Office**

We met the director and staff of the Asia/Pacific Cultural Centre for UNESCO. Mr Yasushi Nishimura, Director, welcomed us and told us that he was wishing for our training to be successful. We then expressed our appreciation for having been invited. We pledged to succeed in our training and make use of the experience gained in training in Uzbekistan, and asked for future cooperation between both countries. Then we visited Nara National Research Institute for Cultural Properties, where we met with Mr Ikuo Tanabe, Director, and Mr Kenichi Kobayashi, Head of Planning & Coordination Section. After lunch, we visited Todaiji Temple in Nara Park. Buildings in the precinct were built in the 8th century and inscribed on the World Heritage Lists. The main hall houses a colossal bronze statue of Buddha. The image is 15 meters tall.

17 July: Training at the Conservation Science Laboratory of the Nara National Research Institute for Cultural Properties

■ **Basic knowledge of the conservation science and its process**

Meeting with Mr Takayasu Koezuka, Director of Center for Archaeological Operations in the laboratory; Mr Yohsei Kohdzuma, Head of Conservation Science Laboratory; Mr Tsujimoto, Chief expert on statue restoration; and Mr Soichiro Wakiya, Fellow researcher. Then, Mr Akmal Ulmasov, one of three participants, made a presentation on "Preservation of Tangible Cultural Heritage and Preparation of Specialists in Uzbekistan." In the presentation, he provided a broad overview of the geography, archeological sites, historical buildings, and the organization of the Ministry of Culture and Sports in Uzbekistan. He also talked about the number of cultural properties in different fields such as archeology, architecture, history and art, as well as the artefacts preserved in the museums as collections. He explained about the restoration department; current conditions and its staff; main cultural properties in large cities such as Samarkand, Bukhara and Khiva; the organization of the cultural properties administration of Uzbekistan; and human resource development efforts in the field of preservation. He furthermore spoke about the organization of museum management, and introduced works of students of the National Institute of Fine Art and Design named after K. Bekhzod. He answered questions about study programs, restoration methods, and restoration/creation of earthenware and murals in Uzbekistan.

■ **Lecture by Mr. Kohdzuma**

Taking coins as an example, the lecture encompassed various chemical and optical analyses, photography and cleaning of metal objects.

- An investigation is conducted before cleaning the metal. A loupe is used at the site. People with 1.0 vision can distinguish a 0.75 millimeter interval from the distance of 20 to 25 centimeters.
- Coins are analyzed using X-ray photography. The object is photographed at same size by photography

technique and can be enlarged up to four times the actual size.

- There is a small electric tool called a “micro hobby router” (tool that resembles a grinder). It can be used to remove rust from metal. A similar device is used in Uzbekistan as well, but it is purely a dental drill and produces a lot of noise, so it is not the same as the small, portable electric router. The routers are sold in Japan for ¥1,000.
- Hydrochloric acid was used in Japan as well for cleaning coins. This chemical substance however ruins coins. A new material has now been developed and new methods are being devised. Hydrochloric acid has a negative impact on bronze coins.
- There is the method of cleaning metal objects by electrolysis. It is however difficult to control and is moreover impractical.

18 July: Conservation Science Laboratory

■ **Introduction of Conservation Science Laboratory and its equipment**

1. Material analysis room (No. 1 laboratory)

Fluorescent X-ray analysis unit Eagle III. Stereoscopic microscope. After analyzing composition of the material, an X-ray diffracto-meter (model M18XHF) is used to identify the types of corrosion products being secondarily formed. In Japan, rusted copper coins are not always cleaned. If they are to be exhibited, they must be cleaned, but if they are to be preserved in the storage, they are not always cleaned. The purpose of analysis is to identify the rust on the surface of copper coins or other metal objects.

2. Material conservation treatment room (No. 2 laboratory)

Three experts work in this laboratory. Metal objects are cleaned here. The metal products are stored on a specially made shelf and constant humidity is maintained. When we visited, humidity on the shelf was 70 percent; however, the optimal humidity for metal is 50 percent humidity. Rust is removed by an air-brasive unit (layer of rust removed from hard substance). The metal objects are cleaned by air pressure of nitrogen gas from a compressor. The nitrogen gas is used because moisture is contained in air. Glass particles or alumina powder is sprayed on the surface from the nozzle.

Compact grinder (resemble dental drill) has various attached tools for all sorts of artefacts. For example, a rubber tip is used for precious metal. It is used in combination with an ultrasonic polishing unit to clean rust from the surface. Metal objects can be analyzed by X-rays whereas wooden objects must not be struck with strong X-rays as those are organic.

3. Wooden product conservation treatment room

This is a large room with several large pieces of equipment where wooden artefacts are provided with conservation treatment. A PEG solution of 30% concentration is placed in a tank, and a wooden tube is immersed in the solution and the temperature is maintained at 55 to 60°. Once a week, powder of 1% concentration is added during one year. The powder is called polyethylene glycol (PEG).

4. Chemistry laboratory for experiments and preservation/restoration

There is equipment for removing chloride from metal. A non-destructive inspection method is used because it doesn’t require taking samples from artefacts, destroying them or touching. In addition to observation by naked eye and microscopes, X-rays analysis is conducted. X-ray waves are shorter than visible light rays. As the wavelength of X-rays becomes shorter, energy becomes stronger. Continuous

X-ray shortest waves are affected by accelerating voltage only, regardless of the type of target material. The correlation of shortest wavelength λ_{min} and accelerating voltage is λ_{min}=12.4/V. Maximum strength in continuous X-ray strength distribution appears near 1.5 times the shortest wavelength. The strength of continuous X-ray increases along with the increase of voltage (V), current (i), and atomic number of the target element (Z). Continuous X-ray strength is $I \propto iV^2Z$. Thus if a stronger X-ray is to be obtained by changing voltage and current, increasing voltage will enable you to obtain a stronger X-ray, but it will alter the shortest wavelength. Current may be increased to obtain a strong X-ray without altering the shortest wavelength.

■ **X-ray laboratory**.

If X-ray strength that is weakened while X-ray (strength of I_0) passes through x centimeters is "I_x", the formula that expresses this relationship is $I_x=I_0e^{-\mu x}$. x : Thickness of specimen, μ: X-ray absorption coefficient. The X-ray absorption coefficient is the percentage of the X-ray that is absorbed as it passes through 1 cm of the substance. If substance density is "ρ," the X-ray mass absorption coefficient is "μ/ρ". This has the substance-specific value. The heavier the element is relative to a certain wavelength, the more absorption coefficient increases, and the more difficult it becomes for the X-ray to pass through. The film is light green before photographing. The film becomes exposed if not kept in a dark place. There is a special cassette for the film. The types of film are IX^{100}, IX^{80}, and IX^{FR}. IX^{100}: High sensitivity, IX^{80}: Medium sensitivity (1/2 sensitivity), IX^{FR}: 20% sensitivity

When taking X-ray photographs, voltage, current, type of film, time, and thickness and elemental composition of the target must be taken into consideration. These factors affect photographs of the target.

- **Experiment 1: X-ray photography of metal objects (1)**
  Before starting work, three types of film (IX^{100}, IX^{80}, IX^{FR}) were set on a cassette in a dark room.
  Two pair of metal plates (set of iron, set of copper) of various thicknesses were set in the center of the cassette. Photographing conditions were one minute at 110 kV of voltage.
- **Results:** When photographing iron plates of 1 to 5 layers, the X-rays were able to pass through 1-layer part, but the contrast with the background was distinct for the 5-layer part. This means the X-rays did not pass through the thick part. In this case, the voltage must be increased and the time lengthened. The degree to which the X-rays pass through depends on the atomic weight and type of metal, voltage and time.
- **Experiment 2: X-ray photography of metal objects (2)**
  Various types of metal plates (Al, Fe, Cu, Sn, Ag, Pb) were X-rayed for one minute at 110 kV of voltage from a distance of 137 centimeters.
- **Results:** Most of the X-rays passed through the aluminum plate at this voltage and time. This means that voltage must be reduced and exposure time shortened. The reason for this is because aluminum is a light metal with a small atomic weight. On the other hand, the atomic weight of three of the metals – tin, silver and lead – is large. The X-rays therefore do not pass through well. The voltage must be increased and the time lengthened. At this time, the distance from the X-rays source is also significant.
- **Experiment 3: X-ray photography of metal (3)**
  The same metals as used in experiment 2 (Al, Fe, Cu, Sn, Ag, Pb) are set and the distance from the

device to the sample is shortened to 82 centimeters. The conditions are one minute at 150 kV of voltage.

- **Results:** As the distance is shortened, X-ray strength increases and becomes able to pass through heavy metal, but the X-ray strength is too large for light metal.

The fact that X-rays spread in a radial pattern from the anticathode, and because the object has thickness, the size of the image on the film produced by X-raying differs from that of the actual image. Also, because the effective focal spot has size, a half shade zone (blurring) exists. As the distance between the object and the film approaches zero, it can be accurately photographed, but because the object always has a certain thickness, the X-ray focal distance may be large. The half shade zone is produced because the X-ray effective focal spot has a certain size. However, the size of the focal point used by the equipment in this experiment is 6 millimeters, the latest models include 0.08 millimeter types. If the focal point size is the same, when the focal distance becomes large, the half shade zone becomes shorter.

19 July: Visit to the "Horyuji Temple Kondo Exhibition" and Kofukuji Temple

We visited an exhibition titled the "National Treasures of Horyuji Temple *Kondo*" The exhibition was held at the Nara National Museum from 14 June to 21 July, 2008. The Nara National Museum is inside Nara Park. Exhibition items were murals, wooden statues, copper statues, clay statues, wooden pedestals, and wooden canopies decorated with lotus flowers for the pedestal. The murals were 2 to 2.5 meters high and 1 to 1.5 meters wide, and consisted of Buddhist motifs. The colorful murals were painted with natural pigments made from clay. The main colors are red and yellow. The contour consisted of black on a red background, and red drawn on a bright background. Wooden replicas are exhibited in the display cases of the exhibition rooms to show the level of Buddhist image manufacturing technology available in ancient times. Spectral analysis of the murals has also been conducted. The visitors were able to obtain all sorts of information on the displayed artefacts they were interested in. Along the way, we visited Kofukuji Temple in Nara Park. A colossal monumental wooden structure is built there. It is a five-story tower 55 meters tall.

20 July: Rested at the hotel.

21 July: National Holiday; we visited Osaka.

22 July: Conservation Science Laboratory

■ **Microscopic observation of 8th century copper coins unearthed at Kofukuji Temple**

The oxidation process is as follows:

1. $\underset{\text{metal}}{Cu} + \underset{\text{chlorine}}{Cl^-} \longrightarrow CuCl + e^-$

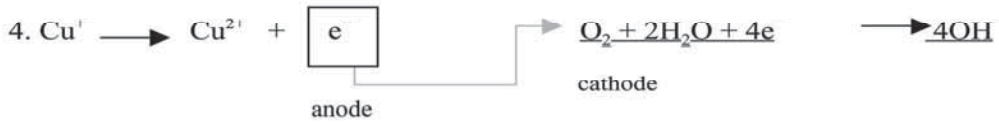
(Cucl is greenish white.)

2. $2CuCl + H_2O \longrightarrow \underset{\text{cuprite}}{Cu_2O} + \underset{\text{acid}}{2H^+} + 2Cl^-$

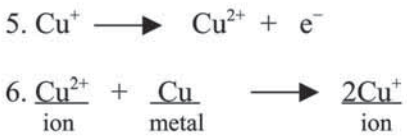
(Cu_2O is red to reddish orange.)

3. $CuCl + Cl^- \longrightarrow CuCl_2^-$ or $CuCl_3^{2-}$

$CuCl_2^-$ and $CuCl_3^{2-}$ are oxides that dissolve in water (i.e., they allow humidity to pass through); they cover the entire surface of the artefacts.

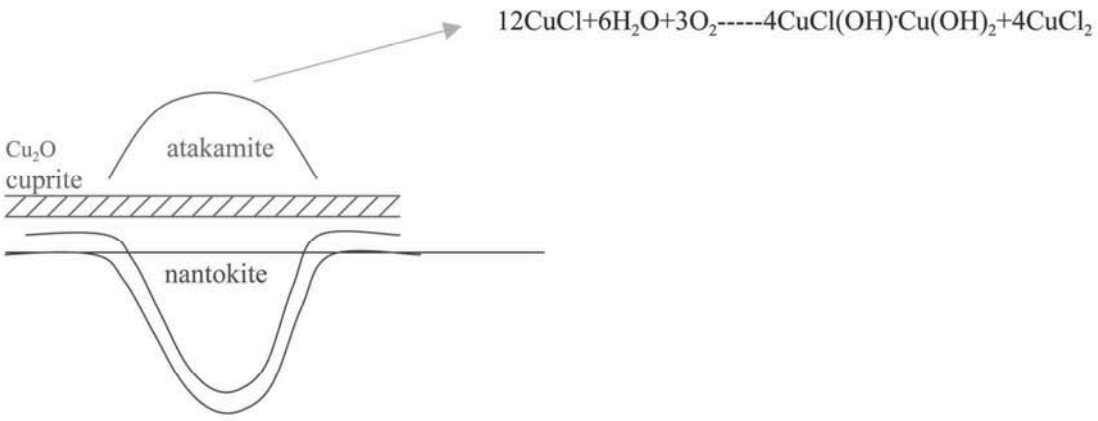


The reaction progresses further when exposed to air.



The oxidation system resembles the mechanism of a battery. There are ions in various types a metal. Electrons are discharged when copper oxidizes. $Cu \rightarrow Cu^+ + e^-$. In other words, metal → ion + electron. On the other hand, reduction is the reaction of taking on electrons. The scale used to express the ease at which a substance releases or takes on electrons is oxidation-reduction potential. This is the electrical potential produced when electrons are exchanged during the oxidation-reduction reaction. The oxidation-reduction potential of copper is 0.522 V and that of iron is -0.409 V.

Electrochemical reaction:



Atakamite is powder form rust. Cuprite is copper oxide. Nantokite is cuprous chloride. If an abundance of carbon dioxide is supplied, the following types of rust are generated:

$CuCO_3 \cdot Cu(OH)_2$ Malachite (green)

$2CuCO_3 \cdot Cu(OH)_2$ Azurite (lapis lazuli [blue])

If the coins are exposed to flames, tenorite (CuO [black]) is produced. There is no need to remove malachite or azurite for storage. Coins can be cleaned when conducting research or observing patterns. Atakamite is the most dangerous type of rust. Benzotriazole alcohol (BTA) is used in the Conservation Science Laboratory for demineralization (stabilization) of coins. If the coins were covered with clay, images must be taken using X-ray photography. Observation of color is also important for gathering information of artefacts. In Sweden, the heating method is used (iron is heated in an oven) to produce hematite (red).

■ **Taking X-ray photography of coins**

Four coins (of 8th century) unearthed at Kofukji Temple sites in Nara were selected for the experiment. The coins were numbered C13-3, C13-4, C13-5 and C17-2. The coins are cast coins having a square-shaped hole in the middle. Chinese characters are inscribed in all four directions.

Observation of various coins:

- The preservation condition of C13-3 is poor. One-fourth has been lost. Two or three millimeter cracks are found on the opposite side. The coins are bent upwards. There is a lot of malachite [$CuCO_3 \cdot Cu(OH)_2$ (green)] rust on the upper half. Cuprous chloride and azurite [$2CuCO_3 \cdot Cu(OH)_2$ (lapis lazuli [blue]) is also seen here and there.
- C13-4: Oxidized in the same way.
- C13-5: Oxidation is progressing. There is clay containing various types of stone and sand around the square-shaped holes. This layer is encrusted with a small amount of blackish-brown dirt. Copper oxide (cuprite) has formed on the rims and some parts are missing. Besides malachite, azurite is also seen underneath the dirt around the square-shaped holes. The rear sides are somewhat rusted, but are basically covered with a dark gray or light gray layer. This is tenorite (CuO). This coin is generally in good condition.
- C17-2: Same

Experiment:

X-ray photography; IX^{FR} film (low sensitivity; for photographing light metals such as aluminum or copper) is used. The coin was photographed under the following conditions (1) – (4): (1) 110 kV of voltage, exposure time of 1 minute, 145 cm of distance between X-ray equipment and target; (2) 130 kV, 1 minute, 145 cm; (3) 110 kV, 2 minutes, 145 cm; (4) 110 kV, 30 minutes, 145 cm.

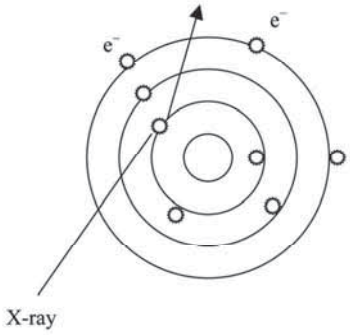
Results:

Voltage was good for (1) but exposure time was a little too short. Voltage was a little high for (2), but exposure time was good. Both voltage and exposure time were good for (3). Voltage was a little too low for (4) and exposure time was too short. Photography was best for (3), i.e., 2 minutes of exposure at 110 kV of voltage. According to Mr. Wakiya, however, even better photography is possible. To do so, exposure time can be further extended (3 minutes at 110 kV, for example); of course the same IX^{FR} film is used. Microscopic observation and comparison of results of X-ray photography are followed. For example, with the C13-3 coin, observation by microscope reveals surface rust, cracks and missing parts. From the results of X-ray photography, the parts where there is a lot of rust, the parts where there is cracking, and parts where there are holes can be seen. The degree of rusting can be clearly determined. The inscription on parts where there is relief appears light, the parts between inscriptions appear darker than the surrounding parts. This means that oxidation is advanced.

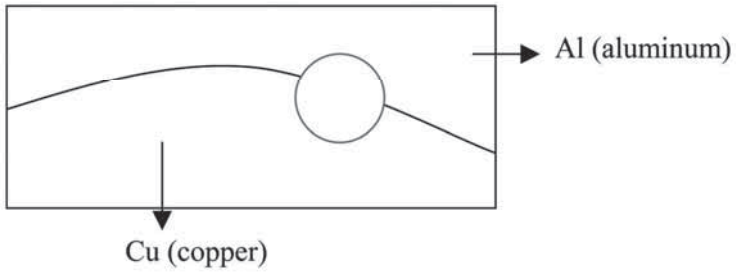
23 July: Fluorescent X-ray analysis in the Conservation Science Laboratory

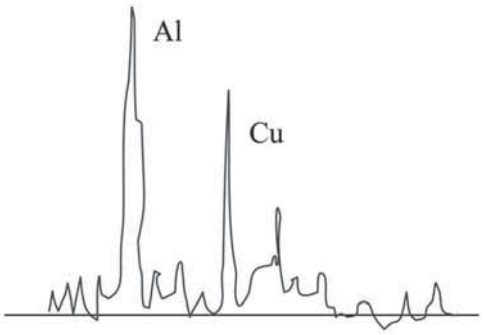
■ **Lecture and practical training in fluorescent X-ray analysis (Mr Wakiya)**

The atoms consist of nucleus (+) and electrons (-). An interaction is produced when the radiation collides with electrons. If the radiation violently collides with the electrons, the electrons are flung free of the atom. Fluorescent X-ray analysis requires elements and interaction. There is a certain fluorescent X-ray analysis for each element. To obtain fluorescent X-ray analysis, a little more energy must be applied.



We analyzed copper and bronze. Because X-rays collide with carbon and nitrogen in the air, it prevents direct advance. The inside of the device is therefore a vacuum. A red circle is displayed on the monitor; the operator views the circle and trains on the part to be analyzed. The diameter of the circle is 0.365 millimeters. The voltage is 40 kV and current is 30 A.





Experiment 1: Copper coins unearthed at Kofukuji Temple (8th century) No. C17-2. The red point is placed on the rim of the coin and it is named "C17-2 brown."

Element	Weight %	Atomic %
Fe (iron)	5.42	7.27
Cu (copper)	2.14	5.75
As (arsenic)	22.28	24.10
Pb (lead)	69.05	62.58
Sn (tin)	0.21	0.30

There is little copper here, and oxidation is advanced.

Experiment 2: Same copper coin. This time, however, the red point is placed on a different location and is named "C17-2 light green."

Element	Weight %	Atomic %
Fe (iron)	3.60	2.55
Cu (copper)	55.61	76.15

There is more copper here.

Experiment 3: C17-2 black

Element	Weight %	Atomic %
Fe (iron)	1.23	0.78
Cu (copper)	66.32	84.71

Here, there is a lot of copper and little iron.

■ **X-ray laboratory**

Experiment 1: The coin is placed on IX^{FR} film and photographed for 2.5 minutes at 110 kV (from distance of 145 cm).

Experiment 2: Photographed for 3 minutes at 110 kV (145 cm).

The results of both are good; the conditions of 2 were better.

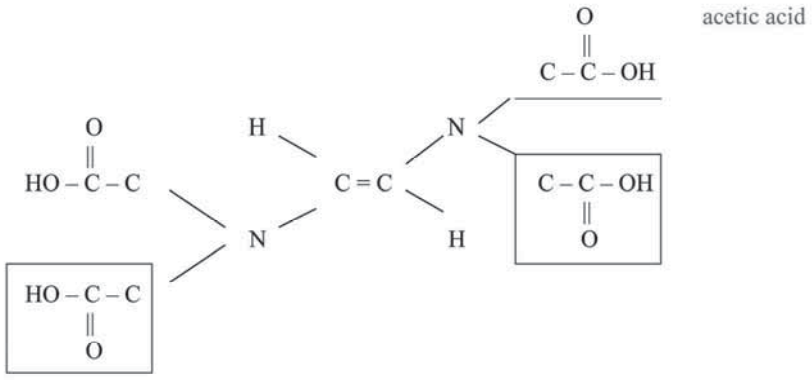
24 July: Training wing of Nara National Research Institute for Cultural Properties

■ **Physical cleaning of coins (practical training)**

Coins are first cleaned with ethanol (99.5 grade) with brush, scalpel and compact grinder (similar to dental drill). There are various tools for the compact grinder. An ultrasonic polishing unit is used in combination with the compact grinder. The ultrasonic polishing unit removes dirt by ultrasonic vibration. A bamboo skewer can be used as a tool.

■ **Chemical cleaning of coins (practical training)**

Experiment: Coins are chemically cleaned by superabsorbent polymer that absorbs ethylene-diamine tetra-acetic acid (EDTA).



There are five types of ethylene-diamine tetra-acetic acid (EDTA): EDTA, EDTA·1Na, EDTA·2Na, EDTA·3Na and EDTA·4Na. The pH is 6 – 7 for each.

Experiment: Coin cleaning with 1% EDTA 3Na aqueous solution

Eight grams of EDTA and 800 grams of purified water are mixed by stirring until the solution becomes transparent. In another container, a small amount of white powder used for paper diapers as well is taken. The powder is a superabsorbent polymer that produces a paste by absorbing water. The paste is applied to the coin. The paste is removed several minutes later and new past is applied. After this process is repeated several times, the coin is washed and immersed in ethanol.

25 July: Conservation Science Laboratory

- Preservation treatment and method of treating metal objects unearthed from the Fujinoki Tomb near Horyuji Temple (lecture)
- Demineralization of coins using benzotriazole alcohol (BTA)

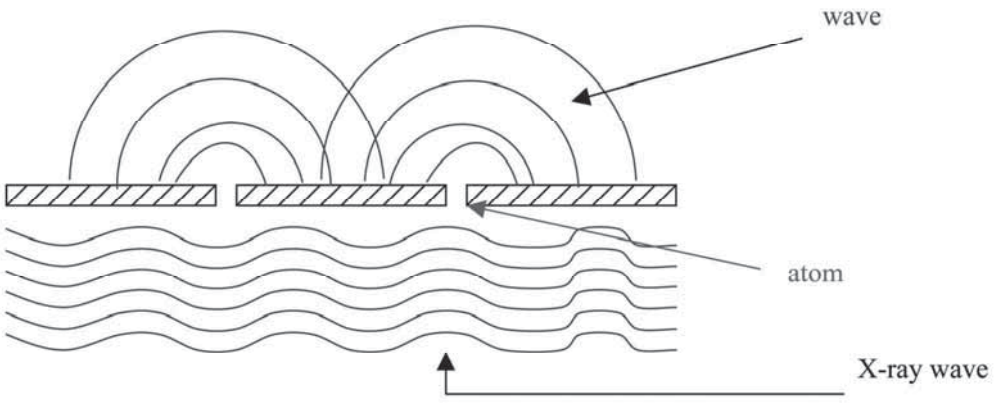
Experiment: Coins are immersed in a 2% BTA solution in which benzotriazole alcohol (BTA) is dissolved in methyl alcohol and then placed in a depressurization case. After allowing the coins to remain under reduced pressure for a day, they are washed with methanol and dried.

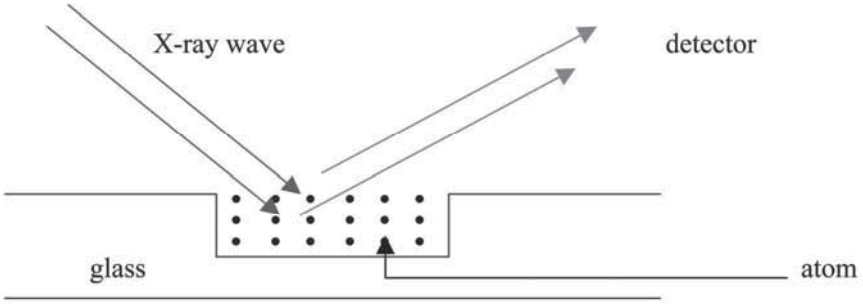
26 and 27 July: (Holidays) Report preparation

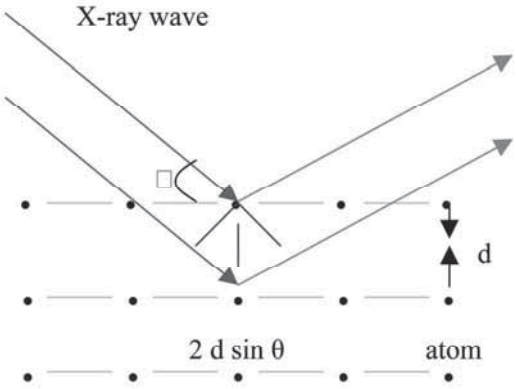
28 July: Conservation Science Laboratory

- **X-ray diffraction (practical training)**

In order to analyze rust of things made of iron, several millimeters of rust were sampled from the bluish-purple part. This is however not azurite. The samples were finely crushed to a powder and placed on a prepared slide. The surface of the sample was flattened out and it was placed in an X-ray diffractometer. Two hours later the results were determined. The results of X-ray diffraction indicate the rust is iron phosphate (vivianite). This indicates that there were bones containing phosphorus next to the object. The level is indicated in the vertical direction of the table showing the results. The peak in the table shows the composition of the substance. The type of secondary corrosion product formed can be identified by the X-ray diffraction method. A database for all substances has been completed, and the atomic grid interval for identifying the necessary substance is known. Data is available in printed form as well as electronic data in computer software. The system analyzes substances by automatic comparison with data in the database. Powdery rust can be easily analyzed. It must be noted that the metal changes color when powdered.







■ **Consolidation of artefacts using B-72 acrylic resin (lecture)**

At the final stage of conservation treatment of metal artefacts, they are impregnated with synthetic resin in order to strengthen the deteriorated parts. Some resins are thermoplastic and some are thermosetting. The former includes acrylic and cellulosic types. Paraloid B-72 acrylic resin is often used for coins.

1. **Acrylic resin:** Acrylic resin is dissolved by organic solvent, not by water.
2. **Emulsion resin:** Emulsion resin is water-soluble. It is not used for coins, but can be used for earthenware.

Ten percent concentration B-72 is sticky and the solution does not penetrate into coins. The concentration may be increased up to 40 percent. B-72 solution is best suited for consolidation of brittle artefacts. B-72 acrylic resin dissolves better by toluene or xylene than acetone. The respective boiling points for organic solvents that dissolve B-72 are 56.5° for acetone, 128.8° for toluene, 140° for xylene, and 57.1° for methyl alcohol. When applying to the surface only, acetone or methyl alcohol will suffice, but if you want the solvent to penetrate deeply, it would be better to use xylene or toluene with low volatility. You may furthermore dissolve acrylic resin in toluene and then add acetone until the proportion becomes 1:1. Some artefacts may contain cavities in which solvent may gather and stay. In such cases, 2 or 3 percent solutions are used. Rohm & Hass of the USA manufactures B-72 acrylic resin.

Experiment: Five percent concentration B-72 is placed in a container, a coin is placed in the solution, the container is placed in a depressurization case, and the pressure is lowered to 0.5 atmospheres. Air pressure depends on the condition of the coin. Solvent penetrates better if air pressure is low. Air pressure must be lowered slowly while observing to see if bubbles come from the material. If lots of bubbles are produced, air pressure must be stopped there. The coin is allowed to stay in this state until evening.

29 July: Conservation Science Laboratory

■ **Physical cleaning of coins (practical training)**

Compact grinder and ultrasonic polishing unit are used.

■ **Computer radiography (CR)**

One advantage of CR equipment is you can take enlarged photographs several times the actual size of the artefact. It also doesn't require any film; the X-rays are picked up by an imaging plate. The size of the focal point of common X-ray equipment is 4 to 6 millimeters; the focal point for CR equipment is 8 microns. In other words, it is 1/500 the size.

Experiment: Coin C15-1 (8th century) unearthed from Kofukuji Temple was photographed for 45 seconds at 80 kV of voltage and 50 mA of current.

Results: The photograph shows holes in the coin and the seal can be seen clearly. This photograph can be enhanced by graphic software such as Photoshop.

■ **Analysis of glass**

Fluorescent X-ray analysis is used to analyze things made of glass. A certain type of glass contains sodium and calcium, while another contains potassium and another lead. Glass containing lead is heavy; this can be determined from its specific gravity. It is hard to distinguish the other two. The oldest glass in Japan is K_2O-SiO_2. The chemical formula for common window glass is Na_2O-CaO-SiO_2. If glass is green, it contains lead, if it is purple, it contains manganese, and if yellow, it contains lead and iron. If glass contains iron, it is light blue. If the iron is in the colloid state, the glass is red.

■ **Packing of unearthed artefacts**

Metal deteriorates when exposed to air, that is, it deteriorates due to oxygen and humidity. There are means of protecting materials from oxygen and humidity. Take for instance the RP system. It uses calcium carbide to absorb oxygen and humidity.

30 July: Visit to library and tourist spots

31 July: Lecture by Mr. Kohdzuma at Conservation Science Laboratory

■ **Environment and facilities for artefact preservation (lecture)**

Using coins as an example, we stabilized and consolidated metal objects. This is the final process, but it does not mean artefacts can be preserved permanently by it. There are two objectives in treating and preserving metal objects. One is to remove dirt. The other is to stabilize. Metal is not stable and oxidation continues. This is because metal mineralizes. Metal oxidizes even if it received preservation treatment. If it receives not treatment at all, it just means it will oxidize faster. Storage conditions must be observed in order to stabilize artefacts applicable for treatment.

Factors that cause artefacts to deteriorate:

- Light: Ultraviolet rays have a negative impact on acrylic resin.
- Dirty air: Gases which have a negative impact such as carbon dioxide and nitrogen oxides
- Small animals and insects: Although small animals and insects don't eat the metal itself, their excrement has a negative impact on metal.
- Earthquakes, unexpected impacts or collisions
- Floods

- Human acts, Deterioration of the global environment

■ **Storage conditions for exhibition items**

International organizations such as International Council of Museums (ICOM) and the International Centre for the Study of Preservation and Restoration of Cultural Property (ICCROM) have provided standards for temperature and humidity for storing cultural properties. Temperature standards for film are 21° for monochrome film and 2° for color; the standard for humidity is 30% or less.

- Humidity standards for paper, things made of wood, fabric and lacquerware are 55 to 65%.
- Humidity standards for ivory, parchment, leather and organic materials are 50 to 60%.
- Humidity standards for murals are 50 to 55%.
- Humidity standards for fossils are 45 to 55%.
- Humidity standards for metal objects, stone or clay are 45% or less.
- The temperature required for exhibition items other than film is 20°.

1 August: Tour of cultural properties in the city of Kyoto

2 and 3 August: Holiday

4 August: On-site lecture I, tour of excavation sites in the prefecture (Kashihara Archeological Institute, Nara Prefecture)

■ **Tour of excavation sites in the prefecture**

Mr Hiroyuki Hashimoto, a executive researcher of Archeological Institute of Kashihara, gave us a guided tour of the excavation site that the institute is involved with. The site was once a rice field. The excavation was conducted prior to construction of a highway interchange. Animal footprints, a former river channel and pottery shards were discovered in the area where we visited first. According Mr. Motomura who is in charge of excavation, the periods of the sedimentary layers are clearly identified. For example, the black clay layer seen at the sight and surrounding area is of the *Jomon* Period. Next, we visited the site on the other side of the road, where structural remains and kiln of 11th to 13th century were discovered.Work is being carried out energetically in both areas. Here we saw various things for facilitating work and creating a good work environment such as machinery (various types of heavy equipment), equipment (belt conveyor) and facilities (prefab buildings for workers). The excavation method was however also practical (separating the areas into grids). We were also interested in the fact that the various cultural layers and lifestyle traces were recorded after being detected. I had an impression that highest attention was paid to cultural properties here.

■ **Visit to see cultural properties of Asuka**

After a short visit to an excavation site near Hinokumadera Temple, we visited Takamatsuzuka Mural Hall. Replicas of artefacts and murals discovered from the Takamatsuzuka Tomb are exhibited here. In order to preserve them, the originals are kept in a storage vault at another place where conditions such as temperature and humidity are maintained at a constant level. The inside of the sarcophagus is decorated with murals and this is drawn on the stone walls. First a solution prepared from seashells was applied to the walls and then the picture was painted with natural pigments. This historical and cultural monument is from the end of the 7th century to the beginning of the 8th century. The earth from the upper portion of the Ishibutai Tomb, which we next visited, exposing the colossal ceiling stone. It is a keyhole shaped tomb.

The floor plan of the stone chamber is square. The first layer consists of three stones each, the second consists of two, and the third consists of three. The ceiling is closed by two colossal stones. The walls inside the stone chamber are flat. The stone coffin was not found, but a replica is exhibited on the side of the tomb.

5 August: Exhibition methodology (Kashihara Archeological Institute)

■ We had an interview with Mr Yoshiaki Kojima, a deputy director of the Archeological Institute of Kashihara. The Institute constantly conducts archeological studies in Nara Prefecture. It appears that excavation will reach 40 to 50 places in a year. Before the construction of any buildings, permission must be obtained from the prefecture. At this time excavation is conducted.

After a brief interview, we visited the museum attached to the Institute. We were able to see a special exhibition that is held periodically. The special exhibition concerned an excavation conducted in Nara Prefecture last year (called "excavation preliminary report exhibition"). The preliminary report exhibition is held each year. This year was the 26th such exhibition. Mr Wataru Kinoshita of the Asia/Pacific Cultural Centre for UNESCO and Mr. Kitai, curator of the museum, showed us around the preliminary report exhibition and the permanent exhibition. Exhibition items were arranged in age periods for both the preliminary report exhibition and the permanent exhibition. All equipment and conditions are provided, exhibition items are placed on exhibition pedestals and the lighting is adjusted. Information concerning artefacts, maps, diagrams of the sites where the artefacts were discovered, and photographs when the artefacts were picked up are exhibited on panels. There were also illustrations to explain how the artefacts were used for visitors. A loupe was provided for viewing small artefacts and there were monitors to provide supplementary information in front of the display cases. One must also not forget that information about the age to which the artefact belonged was displayed for each block of the exhibit. In other words, the artefacts were arranged by period, from the Paleolithic Period (10,000 B.C.) to the Muromachi Period (up to 1603). In a word, the special exhibition and permanent exhibition were planned at the highest level and the exhibition items were displayed in the ideal way so visitors could understand. In many cases, replicas of artefacts were exhibited in display cases while the originals were kept in special condition at a special place. Like other museums, this one also contains lots of models that recreate past ceremonies and building that no longer exist. The models are created by experts or private companies by order of the museum. At this time, the curator of the museum prepares all the design drawings, measured drawings and information required for reproducing ruins, buildings or ceremonies. In the museum lobby is a diorama of Nara Prefecture that shows ruins and public facilities by lamps. Along the walls there are booths where you can see videos about ruins and artefacts.

■ **Visit to the museum main storage and special storage**

The museum is equipped with three storages, each of which is 200 square meters large (about 10 x 20 meters). The first storage we visited contained large and heavy artefacts. The other contained artefacts in boxes on steel racks. One of the storages was of 2-story construction so it could hold lots of artefacts. It was also equipped with a lift for raising and lowering heavy items. There were more than 10,000 boxes of artefacts in this storage; the Institute has about 80,000 boxes of artefacts. The museum also has three special storages. The first one maintains special conditions (temperature of 11° and 60 to 80% humidity)

and contains wooden artefacts placed on racks. Here, the technique of immersing artefacts in a low concentration polymer (concentration is 1.5% in the summer and 1% in the winter) is used. The second special vault contains national treasures and items entrusted to the museum. A temperature of 28° (although the ideal temperature would be 20°) and 50 – 55% humidity is maintained here. The third special storage contains metal objects, film and photographs, drawings, measured drawings and reports of the cultural properties. The museum also has a library housing many books (about 25,000 items). At 4:00 pm, we met with Shinichi Matsuda, who is the director of the museum as well as the deputy director of the Institute. We talked about the impressions of the museum, especially the special and permanent exhibitions and building. The director seemed interested in the National Historical Museum in Tashkent.

6 August: Unearthed artefact arrangement and artefact management/registration system (Archeological Institute of Kashihara)

■ **Guided tour of the Institute by Mr Takushi Toyo-oka, an executive researcher**

1. **Arrangement room**: About ten staff was working for organization and classification of artefacts in a wide space (approx. 6 x 30 meters or 180 square meters). Here, unearthed artefacts are repaired, restored, and are prepared for photographing or exhibition. The room is equipped with a computer-controlled device to facilitate labeling of earthenware. The notes are written in ink dissolved in alcohol so they will not be dissolved by water.
2. **Room for taking measurements and conducting research:** Here, Adobe Illustrator and Pen Tablet (made by WACOM of Germany) are used to trace plan views of artefacts.
3. **Photography studio:** The studio is equipped with the necessary apparatus and equipment, and it offers all conditions required for taking photographs.
4. **Analysis room**: The analysis room is equipped with various types of equipment for analyzing unearthed artefacts such as X-ray equipment and digital microscopes.
5. **Storage for cultural properties**: Primarily metal and wooden objects are stored in at a certain temperature (15°) and humidity (60%).
6. **Materials storage** (approx. 6 x 10 meters or 60 square meters): Plan views of artefacts, books, etc., are kept here at a certain temperature.
7. **Photographs, film, videos and digital memory storage:** Two sections are provided for photograph film; one is for using and the other for storage.
8. **Library** (approx. 10 x 20 meters or 200 square meters): Contains 160,000 volumes and increases year by year. Here only books written in Japanese are kept.
9. **No. 2 Library** (approx. 6 x 8 meters or 50 square meters): In addition to books written in Japanese, the library contains books written in Chinese, Korean, English, French and German. Although few, there are even books written in Russian and Uzbek.
10. **Office** for creating plan views, measured drawings, reports and other documents (approx. 6 x 50 meters or 300 square meters)
11. **International section**
12. **Computer room**: A server (Dell) connects the entire Institute to a single local network. The computers contain special databases created by order of the Institute. Multifunction printer with scanner (Ricoh; can print or scan data of size in meter units).

■ **Practical training in the arrangement room**

We practiced coloring for restoration of *Jomon* pottery (1500 B.C.). Sellite which is originally used for construction, is used for restoring artefacts. It is similar to water soluble cement. Acrylic gouache is used for coloration. Although it is water soluble, once dried it is no longer dissolved by water. We also visited to underground storage. The space is 15 x 18 meters wide and 5 meters high. The container of artefacts holds 24,000 boxes of artefacts on 4 steel racks. The Institute has two other storages.

7 August: On-site lecture II, visit to MIHO Museum

■ We departed for MIHO Museum in Shiga Prefecture in the morning. The museum is located 60 kilometers from the city of Nara. We left the reception hall riding on a special electric vehicle bound for the main gallery of the museum. When we came out of a tunnel on the way there, I felt like I had entered another world. The museum buildings were nestled among the green mountains. It was like the "Peach Blossom Valley" fairyland. We were welcomed by Mr Hajime Inagaki, a curator and head of research, and Mr Sergei Lapchev, special researcher. They gave us an explanation of the museum. The person who selected this location and designed the building was Chinese-American architect, Mr I.M. Pei. Much of the building's structure is underground; the exposed area was therefore reduced to 2,000 square meters and the height lowered 13 meters. An 800-meter tunnel was dug under the mountains in order to carry in materials when the museum was being constructed. Another 200-meter tunnel was dug for visitors. The museum was built over a period of four years, and the interior work took another year. The collections housed in the museum were gathered over that construction period.

■ **Visit to arrangement room**

Here, pedestals and framework for display are prepared, and restoration is performed if necessary. Here, we were shown gold and silver coins of kings of the Greco-Bactrian Period. Next we visited the summer special exhibition, "Sacred Rhyton Drinking Vessel" and observed ryhtons, containers and ornaments by which gods are expressed in the shape of animals. Researchers of the museum have been making research expeditions at Penjikent and the Oxus Temples.

8 August: Kashihara Archeological Institute Conservation Science Laboratory

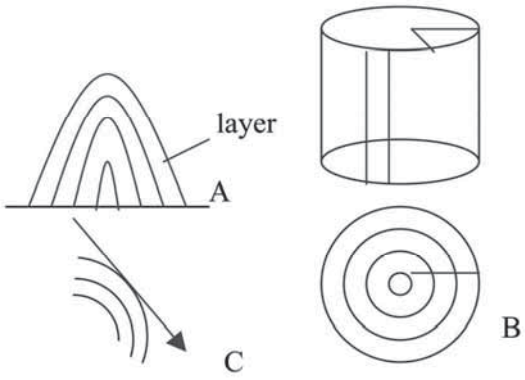
■ Photographing of unearthed artefacts using 3D digitizer (ATOS) (lecture and practical training)

This device can photograph intervals as small as 80 microns, and is useful for analyzing materials. It allows you to compare from any angle if photographs of artefacts are taken before and after restoration. According to senior researcher Masayoshi Okuyama, the device is used for industrial applications. Photographs must be taken several times to photograph an artefact. As an experiment, we photographed a replica of a copper mirror.

■ **Analysis of wooden material (lecture and practical training)**

Analysis by digital microscope is used to determine the type and texture of wood. Trees grow both horizontally and vertically. Trees grow during spring and summer. Trees have horizontal and vertical conduits to carry water and nourishment. Three types of samples were taken for practical training:

1. End grain (cross-section)
2. Edge grain (vertical cut)
3. Flat grain (tangential cut)



Practical training: Wood samples are cut as thin as possible in three direction, placed on a prepared slide and labeled A, B and C. The samples are analyzed using a digital microscope and photographed. The type of wood can be determined from the photographs. For example, the type I analyzed was Japanese cedar.

9 August: On-site lecture III (Okayama Orient Museum)

- **Interview** with Mr Ryuji Shikaku, a curator of Okayama Orient Museum
- **Lecture** by Ms Makiko Tsumura, a curator of the Ancient Orient Museum. Ms. Tsumura gave a lecture on the culture of Uzbekistan. She took questions after a short intermission.

10 August: On-site lecture IV (Okayama Orient Museum)

- **Okayama Orient Museum**

The art museum is based on the collection of Mr. Yasuhara, a local resident, at the initiative of city authorities. The museum began operating in 1979. The personal collector collected archeological art works of the Orient, and sought a new facility to be built as a condition for donating the collection. Before designing the art museum, architect Mr Shinichi Okada visited the Near East, and utilized features of local architecture in the design. The art museum currently has about 5,000 items in its collection, many of which have be donated or borrowed from private collections. In 1995 the museum collected one-third of its funding from city residents, and purchased wall decorations that had decorated the palace of Nimrud (Assyria) from Iran.

- **Lecture of Mr Hiroaki Furusho**, a lecturer of Komazawa University.

The lecturer gave an introduction of Uzbekistan. After providing an overview of the history, geography, mode of life and traditions of Uzbekistan, he gave an introduction of archeological sites in jointly studied by Japanese scholars. After an intermission, we presented our reports of Uzbekistan:

- B. Boliyev: Samarkand: the First Capital of Uzbekistan
- Ulmasov: Buddhist Ruins of Uzbekistan
- A.N. Gorin: Khanpur Tepa: Ancient Ferry of Oxus - Amu-Dar'ya River Bank

11 August: Practical work at museum I (The Ancient Orient Museum, Tokyo)

- **Visit to special exhibition**

"Prof. Sakuji Yoshimura's Excavating in Egypt for 40 years Waseda University Expedition :1966 –

2006." We visited to the exhibition dealing with Egyptian art. Mr Tomoaki Nakano, a curator at the museum, explained the special exhibition plan to us. Japanese scholar Professor Sakuji Yoshimura is among the superior researchers of archeological sites in ancient Egypt. Despite many difficulties at the time, he planned an archeological investigation in Egypt. The Japanese team conducted archeological studies at Giza and Luxor. Prof. Yoshimura investigated the tombs of nobility in the 1980s and discovered 200 mummies. The investigation team conducted X-ray analysis and CT scans of excavated artefacts. This was advanced technology at the time. It was regarded as a rare case as well as progress for archaeological investigation. At the exhibition, you could see all stages of Egyptian civilization from the Paleolithic Period to the new kingdom. One significant discovery in Egypt was stairs decorated with hieroglyphics to date back to 1500 B.C. Charms, wooden and terracotta sculptures, faience (glazed ceramic ware), pieces of stone tables carved with hieroglyphics and many other cultural properties were exhibited. The most surprising exhibition item was a wooden coffin unearthed at Dahshhur being believed to be four thousand years old. Hieroglyphics were painted on the surface of the wooden coffin with natural pigments after being covered with plaster. Two mummies wearing masks were discovered inside the coffin, and are thought to be the oldest mummies. The masks were made of several layers of paper and cloth (now they appear as bandages), and the surfaces are covered with multicolor natural pigments.

■ **Visit to the research department**

We met with Mr Akira Hori and Ms Makiko Tsumura. Ms. Tsumura, a curator of the Orient Museum, taught us how to create a database of artefacts. After that, Ms Saeko Miyashita, a head of the cultural section, gave a lecture on artefacts reflecting ancient games while showing slides. The museum held the special exhibition concerning ancient games several years before. The lecturer introduced artefacts related to games unearthed from Mesopotamia, Syria, Korea and Japan. Artefacts related to a game of Pharaoh Tutankhamen were discovered in Egypt as well. According to her, replicas had to be created because there were few exhibition items at that time in the museum. An ancient game school for children was also planned.

12 August: Practical work at museum II (The Ancient Orient Museum, Tokyo)

■ **Pattern transfer of small artefacts (practical training)**

Seals made their appearance in Mesopotamia around 6000 B.C. Cylinder shaped seals appears about 3000 B.C. Although cuneiform writing naturally disappears with the advent of paper, seals continued to exist. Experiment: Make copies of patterns of cylindrical seals and money on clay and bake for 20 minutes at 120°.

13 August: Practical work at museum III (Tokyo National Museum)

■ **Visit to museum facilities**

First, we visited the second floor of the Heiseikan, and there are four exhibition rooms (3,000 square meters). The museum is equipped with coin lockers for visitors to keep their packages and bags. The exhibition rooms are wide with high ceilings. The walls are 6 to 8 meters to the ceiling and are equipped with cross-shaped lighting. The walls can be changed according to the items on display. There is a control center for managing temperature and humidity. The center lowers temperature when there are many visitors and temperature rises. The museum has many spaces for visitors to rest. Then, we also visited special

exhibition, “Dueling Geniuses - The Greatest Highlights of Japanese Artists”. Art from the *Kamakura* Period to the *Edo* Period was on display at this exhibition. The exhibition items were primarily paintings, pottery and sculpture. The works of artists and craftsmen differ in style and form. The various artists each had their own school. The paintings are drawn on paper to which gold leaf is applied. Some with silver background may also be seen. The exhibition consisted of pairs of rival works such as Unkei and Kaikei, Sesshu and Sesson, Eitoku and Tohaku, Sotatsu and Korin (painters), and Ninsei and Kenzan (potters), Enku and Mokujiki (sculptors of Buddhist images), Jyakuchu and Shohaku, Ike Taiga and Yosa Buson (painters), Okyo and Rosetsu, Utamaro and Sharaku (*ukiyoe* artists), and Tessai and Taikan (painters). They made dark backgrounds on light colored wooden figures and light backgrounds for dark sculpture.

■ **Visit to regular exhibition**

The regular exhibition is held in the archeological exhibition room (1F of Heiseikan). Here we can see exhibition items that represent cultural properties of various ages. For example, there is pottery of the Paleolithic Period, *Jomon* pottery, *Yayoi* pottery, clay figures, copper mirrors, body armor, and sword sheaths. There are also an earthenware coffin and glazed ware from the Kofun Period, architectural ornamentation of the Asuka Period to the Nara Period, and oval gold coins of the Edo Period. Maps of Japan showing where the artefacts were unearthed are provided on the walls so you can see the distribution of artefacts at a glance. Near the entrance is a corner introducing restoration and conservation treatment of cultural properties using multimedia. You can also learn about transportation of exhibition items. The exhibition rooms are equipped with display cases that are unique from the standpoint of shape and color tone. The shape and color tone are adjusted to match the exhibition items. We met with Mr Kosaku Maeda and Mr Kazuya Yamauchi (Japan Center for International Cooperation in Conservation) at the National Research Institute for Cultural Properties, Tokyo. We visited the laboratories, library, office of researchers. They asked us about the progress of our training in Japan with great interest. According to what they said, archeology and preservation are equally important and Japan is interested in Central Asia.

14 August: Practical work at museum IV (Tokyo National Museum)

■ **Visit to exhibition at Gallery of Horyuji Treasures**.

The Gallery of Horyuji Treasures opened in the Tokyo National Museum in 1964. A new building was built in the same spot in 1999. The treasures of Horyuji Temple in Nara are collected and stored here. The new Gallery of Treasures consists of six exhibition rooms:

- Room No. 1: *Kanjo-ban* (banner for the *Kanjo* Ceremony). Ornamental ceremonial religious items. Replicas are draped together with the originals.
- Room No. 2: Gilt bronze statues, halos, repousse’ Buddhist images
- Room No. 3: *Gigaku* masks
- Room No. 4: Wooden and lacquer works
- Room No. 5: Metal work
- Room No. 6: Painting, calligraphy, textiles

There is a data room where we can search the database called “Tokyo National Museum Digital Archive: Horyu-ji Temple Dedicated Treasures” in five languages. The large exhibition room containing 32 gilded bronze statues which are orderly arranged in display cases gave us atmosphere of secrecy. Halos and

oshidashibutsu (Buddha image made by repousee technique) line the walls. The exhibition room is darkened to focus your attention on the exhibition items only. There is nothing around to distract your attention. Even the explanations are on the sides of the display cases. Along the walls are suspended display cases built to match the exhibition items they hold. The temperature and humidity inside the exhibitions rooms is maintained at 22° and 48% relative humidity.

■ **Lecture on museum work and special exhibition planning**

Mr Yoichi Inoue, supervisor of the Curatorial Planning Department gave a lecture on operation and organization of the National Research Institute for Cultural Properties. He also talked about the activities and function of the museum. According to Mr. Inoue, the objectives of the museum is to collect, store, restore, exhibit, conduct research of cultural properties and educate the public. Study and research are the basics of museum work, because academic knowledge is essential for finding, restoring and storage of museum collections. Education is also important. The museum must educate visitors in order to close the distance between the museum and visitors. Experts are involved in this initiative. The experts function as an interpreter between the exhibition and visitors. The experts produce an environment to encourage people to use the museum for their interest. Another objective has also become important. The Tokyo National Museum functions as the National Center for international cultural exchange to disseminate information on Japanese art and history to foreign countries.

15 August

■ **Visit to historical sites in Tokyo**

We visited the University of Tokyo and Nezu Shrine, which was built during the *Edo* Period. The Yasuda Auditorium at the University of Tokyo, is considered as a cultural property with gothic architecture. Mr Kohei Sugiyama showed us around the site on the university campus. *Yayoi* pottery (approx. 2500 B.C.) was first discovered here. The pottery was said to be discovered by a single Japanese archeologist in the pioneer days. The pottery was named "*Yayoi*" after the name of the local area. A monument is built at the site where the pottery was discovered. In other words, people pay a lot of respect to and are proud of their own culture. Another site is located near the university. Beads were unearthed from a tomb that was found here. A large building is currently built here, but the site is marked by a plate on a column of the building which states that the site was discovered here. Along with historical information, the plate contains photographs and X-ray analysis results of the artefacts. It is wonderful that the site is preserved beneath the building and can be viewed again in the future.

■ **Visit to PAReT Co., Ltd**

This company is involved in manufacture and sale of equipment for preservation and restoration of cultural properties. Here you can purchase chemicals, products made of natural materials and tools for restoring cultural properties. Mr Masahiro Hasegawa, CEO, explained the chemical composition of the necessary chemicals and we received a catalog of products for preservation and restoration of cultural properties.

16 August

■ Visit to Soka University.

- We met with Professor Masami Kita, Professor Mitsuru Koyama and Mr. Kenzo Kawasaki. We then visited the university and saw the statue of Alisher Navoi.

- Workshop “Uzbekistan Excavation Study: Primarily Dalvelzintepa” After a speech of Prof. Koyama and an introduction by Mr Wataru Kinishita of the Asia/Pacific Cultural Centre for UNESCO, we gave our presentations.

17 August
Transfer from Tokyo to Nara

18 August
Closing ceremony at Asia/Pacific Cultural Centre for UNESCO: A ceremony for receiving certificate of completion was implemented.

Conclusion

Preservation of historical and cultural properties is not something for one country alone; it is a universal theme. The training for preservation of properties was therefore provided under the joint sponsorship of the Asia/Pacific Cultural Centre for UNESCO and the Nara National Research Institute for Cultural Properties. Japan was selected for the location of training because facilities such as international institutions and Japanese research center, academic centers and museums are concentrated there. These institutions conduct research on theory and practice of preservation and restoration of cultural properties.
We were selected from Central Asia, particularly Uzbekistan. Uzbekistan is blessed with archeological sites and historical buildings from various ages.

The training program is as follows:
- Preservation of and preservation treatment for metal objects. The latest equipment and materials were used on ancient coins as an example.
- Visit to sites currently under excavation. Introduction to exaction method, equipment used for excavation and interpretation method.
- Visit to historical buildings in Nara, Kyoto and Tokyo.
- Introduction to museum work (preservation, restoration and exhibition). Introduction to restoration rooms equipped with the latest equipment, the latest lighting and exhibition methods.

The program includes lectures and practical training. Guidance is provided by experts from various institutions. What we can conclude is that the training was a great success; it was beneficial and important. The administration and society’s interest, respect, attitude and care toward cultural properties were surprising. The latest equipment and apparatus are introduced at restoration sites, and modern techniques for preservation/restoration treatment and analytic investigation of cultural properties are being developed. Sites and buildings are targets for tourism, and all necessary conditions have been arranged for visitors. All sites, we visited, have prepared direction boards, advertisements, posters and pamphlets, and provide guidance that is easy for visitors to understand. What first caught our attention at museums were the location, space-efficient designs, and interior and exterior style and design. Size and style of exhibition contents and display cases are taken into account when the museum was building, and the ornamentation is also proper for the exhibition items. The lighting systems are also well considered, and if necessary lighting

or objects that distract visitors' attention are removed. Domestic and foreign collections are exhibited at special exhibitions under a specific theme, and at periodic or regular exhibitions. Holding various exhibitions in this manner helps museums attract attention of society. The operation system and function of the staff at museums are also accurately and correctly designed. These standards are apparent if you look at the work and activities of the museums. There were many other impressions in my mind, but in a word, I feel I was able to gain knowledge to be utilized and incorporated into my future activities. In the future, I hope to utilize the knowledge I gained from the lectures and practical training for preservation and restoration of artefacts, and to foster young experts in the field of preservation and restoration of cultural properties. I would like to express my deep appreciation for the institutions and individuals who planned and conducted the training.

Final Report

Aleksey GORIN

A program such as the following is planned for the 34-day training session titled “Training Course on Cultural Heritage Protection in Asia and the Pacific 2008-Uzbekistan-”, co-organized by the Agency for Cultural Affairs, Japan; the Asia/Pacific Cultural Centre for UNESCO; and Nara National Research Institute for Cultural Properties.

16 July	Opening ceremony / guidance (Asia/Pacific Cultural Centre for UNESCO)
17 to 18 July	Lectures and training at Nara National Research Institute for Cultural Properties
19 to 20 July	Holidays
21 July	National Holiday
22 to 25 July	Lectures and training at Nara National Research Institute for Cultural Properties
26 to 27 July	Holidays
28 to 31 July	Lectures and training at Nara National Research Institute for Cultural Properties
1 August	Cultural Heritage tour in Kyoto
2 to 3 August	Holidays
4 to 6 August	Lectures and training at the Archeological Institute of Kashihara, Nara Prefecture (including tour of excavation site)
7 August	A visit to MIHO Museum
8 August	Lectures and training at the Archeological Institute of Kashihara, Nara Prefecture
9 to 10 August	Transfer to Okayama; A visit and a presentation at the Okayama Orient Museum; Transfer from Okayama to Tokyo
1 to 15 August	Lectures and training at the Ancient Orient Museum, Tokyo National Museum and The University Museum, the University of Tokyo
16 August	Presentation at Soka University concerning results of excavation of Dalvelzintepa from 2006 – 2007
17 August	Transfer from Tokyo to Nara
18 August	Final report presentation and closing ceremony at ACCU Nara
19 August	Departure for Uzbekistan

Reports are structured in the following order:

1. Lectures and training at Nara National Research Institute for Cultural Properties

Lectures and practical training concerning cleaning and preservation treatment of copper products were provided by Mr Yosei Kohdzuma, Head of Conservation Science Laboratory, Nara National Research Institute for Cultural Properties, and Research Fellow, Mr Soichiro Wakiya.

Lecture 1: Advance observation of artefacts

The lecture discussed problems with advance study of materials (copper coins). At this time, the materials are observed by optical microscope (magnification up to 20 times), digital microscope (magnification 80 to 100 times), and the naked eye. We were handed coin observation record cards and were explained how to correctly fill the cards out. The main themes concerning restoration of copper products are cleaning of dirt and rust and stabilization of the metal (copper).

Lecture 2: Formation and types of rust

Copper oxidizes due to the constant interaction with oxygen. As a result, copper rust (patina) is formed on the surface of the copper. The layer is red. This type of rust is stable, and it protects the surface of copper products from further oxidation. This rust cannot be removed by cleaning.

Rust called “azurite” (blue) and “malachite” (green) sometimes develops on the surface of copper. This is also stable rust, and can be allowed to remain. In some cases, this rust may be removed so as not to lose relief of coin patterns. “Atacamite” is a very dangerous type of rust for the metal of copper coins. It is unstable rust.

Lecture 3: X-ray photography method

The X-ray photography method is used to obtain recognition concerning preservation state or surface patterns of metal copper products. Copper products are placed in an exposure box mounted with X-ray equipment (current is always 5 mA). Electrons emitted from the electrodes are accelerated by a strong electric field between the electrodes and made to collide with the target. A small portion of energy becomes X-rays. The X rays pass through the metal leaving a negative image of the coin on film.

Practical Training 1: Practical application of X-ray photography method

Optimal imaging conditions for the target were obtained with low voltages of 110 to 120 kV. The best film for imaging is medium sensitivity (sensitivity about 55% compared with No. 100 film) or low sensitivity (about 20%). The X-ray exposure time is 1.5 to 2 minutes for medium sensitivity film and 2 to 2.5 minutes for low sensitivity film.

Lecture 4: Fluorescent X-ray analysis

When the target of measurement is exposed to X-rays, secondary X-rays possessing energy characteristic of elements contained in the target are discharged. Fluorescent X-ray analysis is based on such characteristics of various metals. By dispersing and detecting secondary X-rays of individual elements produced simultaneously from these, we can determine the type and amount of the constituent elements.

Practical Training 2: Practical application of fluorescent X-ray analysis

For an experiment, an unknown material (copper coin of Kanishka I [127 – 150 A.D.] was used) was placed in the device and 40 kV of voltage was applied for 50 seconds. The image was magnified 100 times and an X-ray source (tube) was trained on the desired location on the target. After a short period of time, the data is displayed on the integrated monitor of the computer. The fact that, with fluorescent X-ray analysis, the X-rays do not penetrate inside the metal at low voltages, but rather reflect the surface, must be taken into account. In order to accurately determine the composition of metal, the X-ray source must be trained on a

spot where rust has been removed. Oppositely, in order to determine the composition of rust, the X-ray source must be trained on a spot that is rusted.

Practical Training 3: Cleaning of copper coins

There are several methods of cleaning things made of copper, and selection of the method depends on state the target. The most frequently used method is physical cleaning (dry). Several stages are stipulated for cleaning.

- Dirt is removed from coins using a brush and ethanol (99.6% concentration).
- Coins are placed under a microscope (magnified 20 times) and persistent dirt is removed with a scalpel.
- If there is unstable rust (atacamite) on the surface of the coin, it is cleaned using a portable device mounted with a compact grinder and an ultrasonic polishing unit.
- If none of these works well enough, an "airbrasive unit" is used. This is a special plastic box-shaped device with a hole in which to place your hand. The inside is cleaned using a special tube (approx. 5 mm cross-section). A mixture of nitrogen and abrasive are introduced under 0.4 atmospheres of pressure. Fine glass (for soft rust) and aluminum oxide (for hard rust) are used.
- In some cases, coins may be cleaned by super-absorbent polymer. Purified water and a chemical with a complex structure based on ethylenediamine tetraacetic acid (EDTA 3Na) are used for this. Super-absorbent polymer is added to a 1 percent solution of this chemical. The solution should be changed several times according to change in color of the superabsorbent polymer on the surface of the artefact (the agglomerate gradually turns green).

Lecture 4: X-ray diffraction method

If the X-ray affects the metal, a portion of the wave is reflected at a decided angle (diffraction phenomenon). This effect is utilized to determine which rust is covering the surface of the metal.

Lecture 5: Stabilization and reinforcement of metal of coins

After cleaning the coins, a 5 – 10 percent benzotriazole (BTA; 1,2,3-Benzotriazole) alcohol solution is used to stabilize metal from further oxidation. This compound chemically reacts with bullion metal and oxides of the artefact to produce a film that prevents penetration of rust.

The metal of the coins must be fortified following BTA treatment. B72 acrylic resin dissolved by an organic solvent is used for this. A 2 – 5 percent B72 resin solution at volume ratio is added to the toluene and acetone solution (1:1 ratio).

Practical Training 4: Stabilization and reinforcement of metal of coins

In order to enhance the effect on the metal of the benzotriazole alcohol solution, the vessel containing the coins is placed in a depressurization case. The air is slowly removed from the case using a compressor until the atmospheric pressure drops to 0.4 atmospheres. When doing so, one must be careful that the air contained in air bubbles in the metal does not destroy the coin. The vessel is subsequently placed in the device for 24 hours. The coins are then removed from the case and washed with ethanol. The coins are subsequently dried for 24 hours. The metal is then fortified. The vessel containing the B72 resin solution and coins is placed depressurized case for 24 hours by the same method as described above. The coins are subsequently dried for 24 hours. After drying, excess B72 is removed with acetone and a brush.

Lecture 6: Storage of cultural properties

When cleaning and fortification are complete, copper products are more stable. Oxidation is slowed by these methods, but they only temporarily help preserve the main part of the metal. In order to prevent the effect of negative factors on metal, artefact storage conditions must be strictly observed.

Factors having a negative effect:

- Ultraviolet rays destroys acrylic resin coating the metal.
- Carbon dioxide and sulfur dioxide contained in the air, these materials destroy metal.
- Small animals and insects excrement has a negative effect on metal.
- Earthquakes
- Flooding
- Vandalism Religious fanaticism
- Rise in temperature and humidity: Conditions required for storage of artefacts in museums conforming to standards by following organizations:
  - IIC, the International Institute for Conservation of Historic and Works
  - ICOM, the International Council of Museums
  - ICCROM, the International Centre for the Study of the Preservation and Restoration of Cultural Property
- Temperature

  +20°: Monochrome film

  +2°: Color film

  +20°: Other articles
- Humidity

  55 – 65%: Paper, wooden products, fabric, lacquerware

  50 – 65%: Ivory, leather, parchment

  50 – 55%: Murals

  45 – 55%: Fossils

  45% or less: Articles made of metal, stone or clay

  30% or less: Film

Unfortunately it is often impossible to provide the optimal environment for artefacts of all categories when storing them. When storing, therefore, one must satisfy the storage conditions for items requiring the most stringent conditions.

Practical Training 5: Storage method

A hygrothermograph is used to record changes in temperature and humidity in order to observe storage conditions. PR system deoxidizer is used for storage of artefacts not being displayed. PR agent is placed in a multi-ply polyethylene bag and sealed. Wooden products are placed in a multiply polyethylene bag containing water and the air is removed.

2. Lectures and training at Kashihara Archeological Institute, Nara Prefecture

Tour 1: Visit to archeological excavation site on the outskirts of Kashihara City

We visited the excavation site with Mr Hiroyuki Hashimoto, a general researcher of Archeological Institute of Kashihara, and received an explanation from the person in charge of the excavation. During the 2-year

study, a former river channel and ruins of a rice field connected to it were discovered. Footprints of livestock were found in the rice field. The work was performed using a belt conveyor for hauling dirt. Approximately 100 workers are involved in the dig. The excavation site is divided into a grid, and data is recorded according to it. The person in charge of the excavation thinks the rice field and connecting channel may date back to the *Yayoi* Period (about 500 BC to 300 AD). A dwelling and ruins of a forge dating back to the end of the 11th century were found in the adjacent section. A former river channel and *Jomon* pottery shards were also found in this section.

Tour 2: A Visit to Asuka Historical National Park

The Takamatsuzuka Tumulus is located in Asuka Village next to Kashihara City. The tumulus was discovered in 1970 and was excavated in 1972. A stone sarcophagus of stacked stone tablets was discovered inside the ancient tomb. The dimensions are 2.655 x 1.035 x 1.134 meters. A mural was painted on three walls and the ceiling with natural pigments. On the west wall is the image of a group of ladies and a white tiger in the moonlight. On the north wall is a black warrior, visionary creature. On the east wall is blue dragon and another group of ladies. On the ceiling is a constellation chart. Inside the stone sarcophagus is a coffin that is 2.02 x 0.57 meters in size. Weapons and ornaments were discovered inside the sarcophagus. Items discovered included a sword and bronze mirror. All the artefacts are thought to be from the 7th century Asuka Period. Accurate reproductions of the wall murals and items found in the sarcophagus are on exhibit at the Takamatsuzuka Mural Hall. The original murals are stored in a building built especially for storing them. The Takamatsuzuka tumulus itself housed the original murals (inside the sarcophagus) for a long period of time. The sarcophagus has however already been disassembled, and the facilities built next to the tomb to store the murals is about to be torn down. In Asuka Village, there also is the rectangular Ishibutai *Kofun* tumulus from which the colossal ceiling stone is exposed.

Practical Training 1: Colouration of restored earthenware

Earthenware discovered by excavations is washed and noted by hand or by special machine. The shards are subsequently joined and reinforced with plaster. The final stage is coloration of the earthenware reinforced with plaster. Acrylic paint is used to color the earthenware. In order to obtain the necessary color, the paints are mixed in advance and are test-painted with a small amount. If the color is suitable, several coats are applied to the necessary places. The paint is subsequently dried.

Lecture 6: Usage of 3D laser scanners for storage of cultural properties

An ATOS 3D 3-dimesnional digitizer (GOM product) is used in order to obtain a 3-dimensional model of the artefacts. Measurement reference points that reflect infrared rays are applied to record the target using xyz coordinate systems. The 3D model thus obtained most accurately expresses decorative relief.

Practical Training 2: Determining tree species based on wood structure

In order to determine tree species, one must separately research the characteristics of the structures of each respective type of wood. Several samples are taken in order to do this.

- End grain (cross-section)
- Edge grain (vertical cut)
- Flat grain (tangential cut)

Specimens are cut by a razor's edge; the necessary thickness is several microns (light must pass through under a microscope magnifying the image 50 times the actual size). The specimen is carefully placed on a prepared slide and covered with a cover glass. If the structure is not clearly visible, the image of the specimen is saved in a computer connected to the microscope. The specimen is placed in a glass tube containing water and the glass tube is labeled with data concerning the sample. Photographs of the specimen are compared with those of certain reference materials with the structures of tree species seen in Japan to determine the species.

3. Okayama Orient Museum

The Okayama Orient Museum was founded 30 years ago. The collection was built upon on private collections. The collection consisted primarily of Oriental archeological artefacts of art. Egyptian and Middle Eastern objects of art were subsequently added. The special exhibition being held when we visited was on the decorative arts and crafts from Central Asia.

4. Lecture and practical training at the Ancient Orient Museum, Tokyo

A visit to the special exhibition

During training at the museum, we visited a special exhibition in the exhibition rooms of the museum. Many of the artefacts pertained to work of Waseda University Professor Sakuji Yoshimura in Egypt. Artefacts unearthed from Luxor were exhibited. Our attention was particularly drawn to the room that introduced the excavation of the mausoleum where the mummified remains of exalted personage were discovered. A lot of space at the Ancient Orient Museum is allotted to exhibitions, and there were artefacts exhibiting cultural features of ancient Mesopotamia (Iraq), the Middle East (Syria), Asia Minor (Turkey) and Iran.

Practical Training 1: Creation of database for coins and other archeological artefacts

Practical Training 2: Seal imprint transfer

A special organic resin is used for transferring seal imprints. The required amount of resin is softened by kneading until it takes on plasticity. It is then flattened and sprinkled with a fine powder substance. This is so the resin does not adhere to the target from which the imprint is to be taken. The transferred imprint is then baked in an oven for 20 minutes at 120°. When it bakes, the resin is hardened. This completes transfer of the imprint. Resins of several colors are used for imprint transfer. The colors are green, blue, purple, orange and gray. The patterns of coins can be transferred by a similar method.

Lecture: Dice-playing in the Orient

Dice-playing has been known since the third millennium B.C. The first records of the game are contained in historical data of ancient Egypt and Mesopotamia. The game is simple to play; the joints of bones were used as dice. The rear portion of the ankle joint of large horned animals (cows) and of small livestock (sheep) was used to make the dice. Dice of similar shape were subsequently made from other harder materials. In later ages, more complex games using dice were popular. Game boards appeared, and the games subsequently took on gambling characteristics. As dice gambling spread, it began to be regulated by the nation. Intellectual games using bone products appeared a little later in the 5th to 6th centuries. Dice-playing was also popular in medieval Japan. The game was so popular, the government had to issue

ordinances prohibiting gambling. Games that use dice still remain as an important element of sub-culture in many countries.

5. Tokyo National Museum

The Tokyo National Museum opened in 1872. The museum currently consists of four independent exhibition halls. Japanese art work, historical and archeological data are exhibited inside them. Aside from this, oriental art is also displayed. The collections stored in the museums include 100,000 items. The museum is visited by about 2,000 people each day, which may sometimes climb as high as 12,000 when there is a special exhibition.

6. My Impressions

Japan is a country of marvels. It consists of four comparatively large islands and many other smaller ones. Although it has a population of 120 million, it has a little inhabitable land. With the persistent lack of resources, the country has produced an enterprising ethnic group which has a surprising affinity for work. Many travelers, tourists and people who have associated with Japanese people for many years have noticed these astonishing features in the personalities of Japanese people. I was also surprised at this characteristic from the first day of my stay in Japan. What gave me the most favorable impression was the courtesy of Japanese people, which immediately caught my attention. I was also impressed by hospitality of Japanese people that is so surprising it could almost sometimes be called a service. Also, Japanese accept the world around them by in a completely unique way. They have a huge passion for and apply themselves diligently to protecting natural and cultural heritage. This all probably comes from Japanese people's special sense of beauty. This is the extremely subtle understanding of the brilliant nature surrounding their island world. This surely defines Japanese people's subtle approach when preserving and restoring cultural properties. Restoration is a job that demands persevering and meticulous types of person. I believe that these attributes are truly inherent traits of Japanese people. The Japanese archaeologists are always sufficiently equipped in the laboratory as well as at the site, and the experts are highly skilled. This had a most favorable impression on me.

V. Appendix

1. List of Participants
2. List of lecturers and Interpeters
3. Staff Members ACCU Nara

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