Training Report
on
Cultural Heritage Protection

Training Course for Researchers in Charge of Cultural Heritage Protection in Asia and the Pacific 2010 - Mongolia -

16 November -16 December, 2010, Nara, Japan

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

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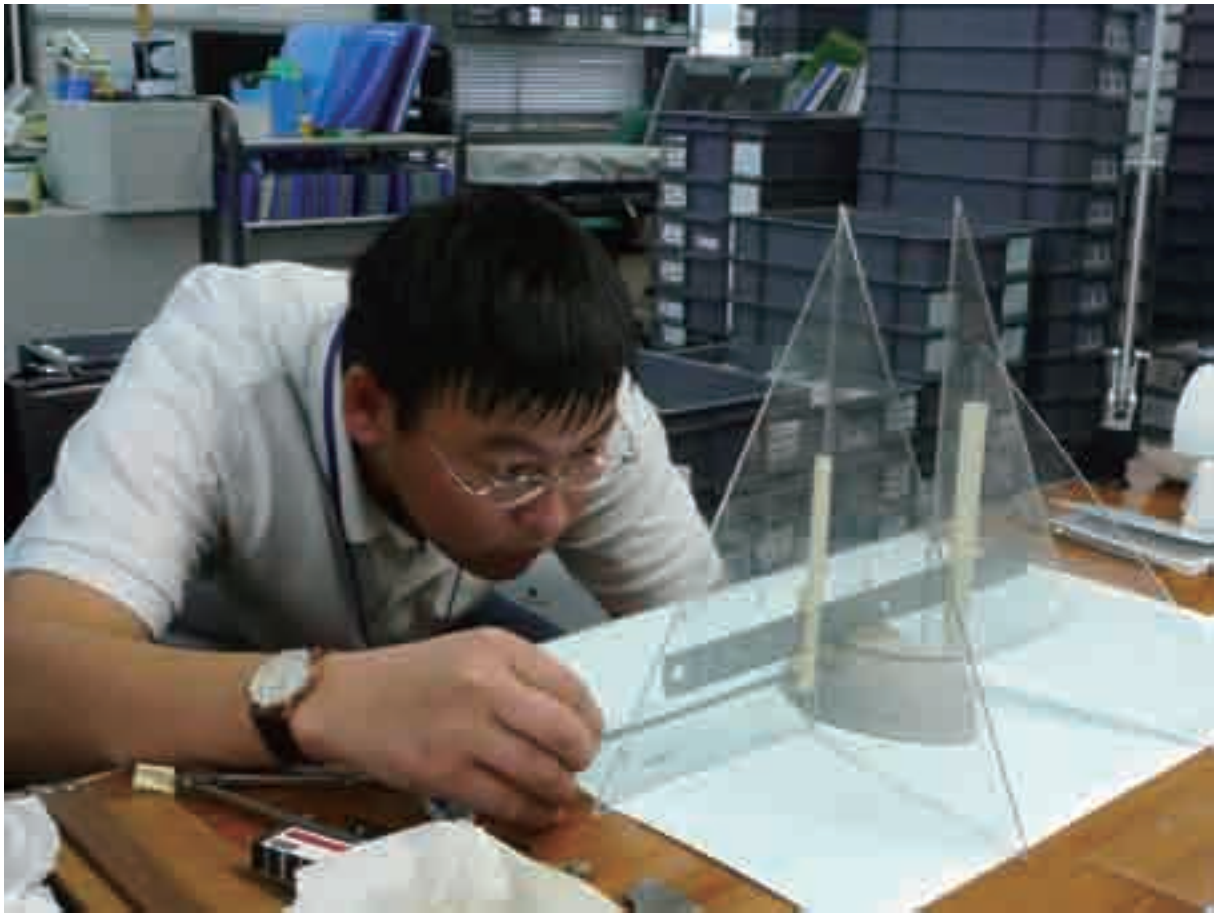
Practical training on plane-table surveying



Measured drawing of earthenware

Taking photographs with a film camera

The closing ceremony at the ACCU office

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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. Subsequent to its establishment, our office has been implementing a variety of programmes to help promote cultural heritage protection activities, in close cooperation with the Agency for Cultural Affairs, Japan (Bunkacho); National Institutes for Cultural Heritage, National Research Institute for Cultural Properties, Tokyo and Nara; the Nara Prefectural Government; the Nara Municipal Government; universities; and museums.

The ACCU Nara's activities encompass training programmes for the human resources development; international conferences and seminars; the training of young leaders in cultural heritage protection; the website for the dissemination of information relating to cultural heritage protection; and the world heritage lectures in local high schools. In addition to those, ACCU Nara Office offers "the Local Training Workshop" which dispatches a group of lecturers from Japan and implements the practical training on cultural heritage protection on sites. Besides, we annually appoint "International Correspondents" from each country for the purpose of establishing closer ties with the countries in the Asia-Pacific region, who will periodically send latest reports on cultural heritage protection in their country.

Our office has been conducting two types of the training course in Nara: for the group and for the individuals. The group training course offers the opportunity to sixteen experts from Asia-Pacific region for about one month with two themes in alternate years: "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.

ACCU Nara has learned that one of the most urgent issues currently facing Mongolia is a shortage of trained experts for cultural heritage protection, and therefore we have invited three researchers into the Individual Training Course 2010 for providing them with basic and practical techniques on recording/documentation of archaeological sites and artefacts. They belong to Institute of Archaeology, Mongolian Academy of Sciences, being engaged in excavation and research on cultural heritage protection in Mongolia. This programme was also organised so as to provide them with opportunities to be exposed to as many reconstructed or restored heritage sites in Kyoto, Nara and Kyushu districts as possible. They saw with their own eyes how the sites were preserved and managed in Japan. It is hoped that their acquired knowledge and experience will contribute to heritage protection activities back in Mongolia.

Finally, we would like to express our sincere appreciation to Agency for Cultural Affairs, Japan (Bunkacho); Nara National Research Institute for Cultural Properties; the Museum, Archaeological Institute of Kashihara; Nara University; Office of Yoshinogari National Historical Park; Saga Prefectural Board of Education; Kyushu National Museum; and Dazaifu Municipal Board of Education 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 2010 - Mongolia - (16 November - 16 December 2010, Nara)

1. Organisers

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

2. Background

The democratisation of Mongolia in 1990 enabled Japanese researchers to continuously participate in archaeological and historical survey in the country. It was gradually revealed through these projects that Mongolia also expected Japanese aid in the field of cultural heritage protection. Accordingly, to explore the feasibility of implementing sustainable and comprehensive international cooperation in the sphere of cultural heritage protection, researchers from JCIC-Heritage (Japan Consortium for International Cooperation in Cultural Heritage) carried out survey in Mongolia as part of its project in 2008. They reorganised and analyzed various challenges currently facing Mongolia in the report and revealed that one of the most serious issues was a shortage of heritage professionals on protection. Related parties in Mongolia expressed high expectation for Japanese support and cooperation in human resource development.

ACCU Nara began accepting nomination by the members of JCIC-Heritage for annual "Group Training Course" from 2008, and promoted cooperation with them to the "Individual Training Course" in order to make the best use of their research result from 2009. Accordingly, ACCU Nara invited three researchers from Mongolia into the training programme on conservation science in 2009. Even after that, authorities concerned in Mongolia repeatedly requested to implement training on archaeology and the organisers have decided to invite three promising researchers from Mongolia to the above mentioned training course, being highly beneficial to the protection of cultural heritage in the country.

3. Date and Venues

Date: 16 November (Tue.) to 16 December (Thur.) 2010. [31 days]

Venues: Cultural Heritage Protection Cooperation Office, ACCU (ACCU Nara); Facilities and museums of cooperating organisations, etc. Please refer to "Individual Training Course Schedule 2010" for each venue.

4. Objectives

A sequence of the individual training course aims at mainly providing participants with the opportunity to acquire basic knowledge and practical techniques on recording/documentation of sites (mainly on structural remains and artefacts) such as measurement, measured drawings and photography.

5. Training Curriculum

- (Lecture) Introduction to Recording/Documentation of Sites and Artefacts
- (Practical Training) Recording/Documentation of Structural Remains: Measurement, Measured Drawing and Photography
- (Practical Training) Recording/Documentation of Artefacts: Measured Drawing and Photography
- (Study Tour) Site Management/Maintenance and its Utilisation in Japan

6. Participants

MUNKHUU Bayarsaikhan (Mr)

Head of Research Group, Department of Paleoanthropology/Paleozooology, Institute of Archaeology, Mongolian Academy of Sciences

Date of Birth: 15 December 1972 (Age 37)

RINCHINKHOROL Munkhtulga (Mr)

Researcher, Department of Middle Age Archaeology, Institute of Archaeology, Mongolian Academy of Sciences

Date of Birth: 18 October 1980 (Age 29)

DAVAAKHUU Odsuren (Mr)

Researcher, Department of Stone Age Archaeology, Institute of Archaeology, Mongolian Academy of Sciences

Date of Birth: 15 February 1983 (Age 27)

7. Process of Invitation

Mr Altangerel Enkhtur, Head of Middle Age Period, Institute of Archaeology, Mongolian Academy of Sciences recommended three applicants suitable for the above mentioned invitation programme as participants. Then ACCU Nara Office has determined to invite three applicants as participants through close examination.

8. Others (Past achievement to accept participants)

Since 2000 when the above-mentioned invitation programme started, thirty-eight participants from fourteen countries have been accepted.

9. Certificate

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

10. Language

Mongolian is the main working language of the course.

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 16 November (Tue.) to 16 December (Thur.) 2010. Arrangements for accommodations will be made by ACCU Nara.

12. Secretariat

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2. Programme Schedule

Date			Schedule		Lecturer (Venue)
November	16	Tue.	Opening Ceremony	Orientation to the Programme	ACCU Nara
	17	Wed.	Introduction to NNRICP: Facility Tour	Site Management and Utilisation: Heijo Palace Site	NNRICP
	18	Thur.	On-site Lecture: Site Management and Utilisation / Museum Visit		NNRICP
	19	Fri.	Introduction to Recording/Documentation of Site	Forum: GIS for Site Prospection	NNRICP
	20	Sat.			
	21	Sun.			
	22	Mon.	Organisation of Artefact in Practice	Information System of Site	NNRICP
	23	Tue.	On-site Lecture: The World Heritage site in Nara		Nara Pref.
	24	Wed.	Research Facility and Site Management in Practice		Nara Pref.
	25	Thur.	Storage & Management of Artefacts	Site Management in Practice	NNRICP
	26	Fri.	Introduction to Dendrechronology	Introduction to Enviromnental Archaeology	NNRICP
	27	Sat.			
	28	Sun.	*ACCU International Seminar 2010*		Nara University
	29	Mon.	Introduction to Recording / Documentation of Artefact	Recording/Documentation of Stone Objects	NNRICP
	30	Tue.	Recording/Documentation of Roof Tiles		
December	1	Wed.	Recording/Documentation of Earthenware		
	2	Thur.	Recording/Documentation of Earthenware		
	3	Fri.	Recording/Documentation of Earthenware	Conservation Science for Sites and Artefacts	
	4	Sat.			
	5	Sun.			
	6	Mon.	On-site Lecture: Historic Monuments of Ancient Kyoto		Kyoto Pref.
	7	Tue.	Research Method for Artefact	Facility Tour of Nara University	Nara University
	8	Wed.	[Transfer from Nara to Fukuoka]	Study Tour: Site Management and Utilisation in Practice	Yoshinogari Historical Park, Saga Pref.
	9	Thur.	Study Tour: Site Management and Utilisation in Practice / Museum Visti		Kyushu National Museum / Dazaifu Site, Fukuoka Pref.
	10	Fri.	Study Tour: Site Management and Utilisation in Practice		Itazuke Site/ Fukuoka City Archaeology Center
	11	Sat.	*[Transfer from Fukuoka to Nara]*		
	12	Sun.			
	13	Mon.	Recording/Documentation of Site and Artefact: Photography		NNRICP
	14	Tue.			
	15	Wed.	Writing Final Reports		ACCU Nara
	16	Thur.	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

II. Summary of Lectures

Summary of Lectures

16 Nov. (Tue.)

■ Opening Ceremony

The opening ceremony began with a welcome message by Mr Takahashi, Deputy Director of ACCU Nara. The three participants (Mr Bayarsaikhan, Mr Munkhtulga and Mr Odsuren) from the Institute of Archeology of the Mongolian Academy of Sciences expressed their determination to study hard and introduced themselves.

- At the orientation, the training schedule was explained, study materials were passed out and precautions were conveyed.
- Participants visited Gokurakubo Hall of Gango-ji Temple, which is one of the structures of the World Heritage "Historic Monuments of Ancient Nara." After hearing an outline of the temple, they saw the Mandalado (Gokurakudo) Hall and Zen Room, which are both national treasures. The Zen Room was opened to the public as part of a special unveiling of hidden treasures and rarely-seen Buddhist statues of Nara, which was done for the 1300th anniversary of the Heijo-kyo Capital. They also viewed structural members, roof tiles and other items from the Asuka period that were on display in the Zen Room. All of the participants showed interest in the structural members from 1,400 years ago that were still in existence today.

Mr Takahashi, Deputy Director of ACCU Nara

17 Nov. (Wed.)

■ Introduction to National Research Institute for Cultural Properties (NNRICP): Facility Tour <INOUE Kazuto and SHIBA Kojiro / NNRICP>

Mr Inoue, Deputy Director, outlined the organisation and operations of NNRICP in which the training will be taken place.

- Though it has been reorganized, since its inception NNRICP has been an "organisation for researching the administrative protection of buried cultural properties" and consists today of administrative staff and researchers in the various fields of archeology, documentation, architecture, archaeological science, site management, cultural landscape and so on.
- Research includes excavations, technical training in cultural properties, basic research into cultural properties protection, international cooperation and joint research, and more.

Next, the participants toured the NNRICP facilities under the guidance of Mr. Shiba. Besides observing

the laboratories and the library, they heard explanations of the aerial photograph search system and document search engine used with the housed collection of documents. After that, they walked about the Nara Palace Site Museum on their own.

■ **Site Management and Utilisation: Nara Palace Site** <SHIBA Kojiro / NNRICP>

The participants were shown the restoration progress in the Nara Palace Site. At the reconstructed First Audience Hall (dai-ichiji daigokuden), they observed the base isolating structure beneath the foundation. They next walked to the Second Daigokuden Audience Hall site →Imperial Domicile (dairi) → Excavation Site Exhibition Hall → Suzaku Gate, seeing for themselves the various development methods including plan views, layouts demarcated by vegetation, restoration of foundations only, full reconstruction of structures, etc. Also, at the Excavation Site Exhibition Hall, an explanation was given of the pros and cons of exposing and displaying structural remains.

Facility tour

Lecture by Mr Shiba

18 Nov. (Thur.)

■ **On-site Lecture: Site Management and Utilisation / Museum Visit** <KATO Shinji and NARITA Satoshi / NNRICP>

- The participants visited the Yanagimoto Tombs to see the enormity of them up-close, then met with instructors at the Asuka Historical Museum, from where they went to the Ishibutai Tomb built in the sixth century. At the site, an explanation was given of the sideways tunneled stone burial chamber and particularly the construction method of using mammoth stones.
- The explanation of the permanent exhibits at the Asuka Historical Museum. The participants were particularly interested in the Takamatsuzuka Tomb and the wall paintings of the Kitora Tomb.
- The special autumn exhibit “Early Wooden Tablet – The Beginning of Written Records in Japan” and the replicas of the Asuka stones on display in the garden of the museum.
- After an explanation of the temple layout discovered in excavation at Asuka-dera Temple, they also learned on many stones (Kame-ishi and Sakafune-ishi stones) from the Saimei era (665-667).
- The permanent exhibit and special autumn exhibit “Craftsmen of Ancient Nara – The Archeology of the Great Buddha” at the Museum of the Archeological Institute of Kashihara, Nara Prefecture.

The Ishibutai Tomb

Lecture by Mr Narita on site

Lecture by Mr Kato on site

- Mr Matsuda, Director of the Museum, introduced examples of overseas research by the Archeological Institute of Kashihara, especially on joint research projects in Mongolia.

19 Nov. (Fri.)

■ **Introduction to Recording/Documentation of Site** <OBAYASHI Jun and OZAWA Tsuyoshi / NNRICP>

The participants had lectures on survey and zoning methods used in site excavations.

- To record a site, a grid pattern is created and the positions of artefacts are plotted on the grid. The participants learned how to create grid patterns by looking at the Heijo Palace Site and corresponding grid.
- How to make record cards for cataloging artefacts unearthed from excavation sites. Water-resistant paper was used at the Nara Palace Site because of the high water content of the ground. Records are kept on a daily basis in a log and detail what was unearthed, where and have space for adding comments later.
- How excavation sites of the Nara Palace Site were divided into administrative zones. Excavations were managed by four administrations: Nara Prefecture, Nara City, NNRICP and Yamato-Koriyama City.
- NNRICP divides its seventeen researchers into four research groups assigned for about three months to a specific site. They then rotate to other sites over the course of the year. In addition, they receive many requests for surveys that Nara City requires prior to new constructions. The participants were surprised to know that there were many sites excavation here and there across the city.
- Practical training on GPS: it usage and necessary equipment.
- Practical training on plane-table surveying: the basics of setting a reference point and then making measurements by moving to a second point, third point and so forth. Participants made measurements by themselves, but the results were not as good as expected, perhaps because there was not enough distance between points.

Lecture by Ms Obayashi

Lecture by Mr Ozawa

■ **Forum: GIS for Site Prospection**

The participants took part in GIS workshop organized by the Data & Information Section of the Department of Planning & Coordination of NNRICP. Despite all presentations were in Japanese, the participants showed keen interest in 3D survey maps. It was apparently difficult for them to grasp everything through sequential interpretation.

1. “Practice and Examples of Measurements and 3D Surveying at

Osaka City University" by Mr KISHIMOTO Naofumi, Osaka City University.

2. "Integration of Detailed Geographical Survey and Underground Prospection Data" by Mr TSUMURA Hiroomi, Doshisha University: Tsumura
3. "FOSS4G in Archeology" by Mr SEINO Yoich, Kyoto University
4. "Structures of Site Survey Maps" by Mr MORIMOTO Susumu, NNRICP

22 Nov. (Mon.)

■ **Organisation of Artefacts in Practice** <KUWATA Kuniya, KUNITAKE Sadakatsu, MORIKAWA Minoru and SEINO Takayuki / NNRICP>

- Preparatory Section
  - The participants visited Preparatory Section of NNRICP where does temporary work before conservation treatment and storage.
  - Wooden tablets: The work flow of rinsing, cataloging and temporarily storing was explained.
  - Wooden artefacts: The work flow up to primary conservation treatment and its management procedures were lectured besides chemicals and equipment used for treatment. Also, the management system for artefact with computer was shown.
  - Earthenware: The flow of rinsing, marking (on the earthenware), gluing, measuring and restoration done was explained.
  - Roof tiles: The work flow for tiles is basically the same as that for other artefacts, therefore the history of roof tiles was outlined and then explanations were given of points that researchers should observe in roof tiles, using eave tiles as examples.

Lecture by Mr Kunitake

■ **Information System of Site** <MORIMOTO Susumu / NNRICP>

- An explanation was given of the cultural properties databases created (including revised and updated) and used by the NNRICP.
- There are two databases: one that is online and open to the public, and the other is only for inside use. The latter is for daily research operations and contains raw data and uncertain information.
- The open database was introduced to the participants.
- Examples were shown of managing cultural properties databases on computer. Huge excavation data can be integrated by GIS. This has to do with computer capacity being limited by large amounts of data. An example from Bamyan was shown to illustrate site mapping using GIS and satellite photographs.

Lecture by Mr Seino

Lecture by Mr Morimoto

23 Nov. (Tue.)

■ **On-site Lecture: The World Heritage Site in Nara**

- After learning about "reconstruction controversy" of Horyu-ji Temple, Wakakusa-Garan (temple site) and transitions of Sai-in (the western precinct) since its original construction, participants visited the middle gate → five-tiered pagoda → lecture hall → main hall.
- They heard an explanation of how the clay statues were made at the five-tier pagoda and noticed the differences between Shaka Triad (three statues of Buddha) from the Asuka period and the images of Buddha in wall painting from the Hakuho period at the main hall.
- At the Gallery of Temple Treasures (built 12 years ago), they observed National Treasures and Important Cultural Properties such as Yumechigai Kannon, Tamamushi Miniature Shrine, Kudara Kannon and handmade three-tiered miniature pagoda.
- Beyond the east gate in the eastern precinct of Prince Shotoku's Ikaruga Palace, the participants viewed the Hall of Visions and Guze Kannon.
- At the Ikaruga Bunkazai Center, the participants were guided through artefacts unearthed from the Fujinoki Tomb and nearby areas in the "Tombs of Ikaruga" special autumn exhibit by local staff Mr ODA Yoshihiro. After that, they visited the Fujinoki Tomb that had been developed as a historical site.
- At Yakushi-ji Temple, an overview was lectured on the layout of the twin tower precinct and the sanctuaries relationship with Honyakushi-ji Temple in Kashihara City. They then went around the grounds viewing the south gate → middle gate → towers and main hall → lecture hall → north gate. They saw the east tower as it was before restoration and felt the distance from the center to the south and north gates on foot.

At precincts of Horyu-ji Temple

At Ikaruga Bunkazai Center

Five-tiered pagoda at Horyu-ji Temple

24 Nov. (Wed.)

■ **Research Facility and Site Management in Practice** <MORISHITA Keisuke and NAKAJIMA Kazuhiko / Nara City>

- Center for Archaeological Operations is responsible for excavating buried properties in Nara City. The director explained the highlights of the Nara Palace site that Nara City is currently excavating. The participants were particularly interested in the fact that the palace did not have any fortifications and asked questions about defenses in the Nara Period. In response, the instructor explained about guards, garrisoned soldiers, mountain-top fortifications, moats and so forth.
- A guided tour of the special autumn exhibit of "Earthen Roof Tiles of the Nara Palace Site" that

opened in 2010 at the institute. They learned about the transition in roof tiles of the Nara Period, how they were made and so forth.

- Practical training at Daian-ji Temple began with an explanation of how the remnants of the south gate were displayed. After viewing important Buddhist statues, the participants saw the east tower site where excavation had been completed but development not started. Next, they saw the north side priests' quarters where the foundation ground and stones were visible, and the second kiln for firing the roof tiles. The kiln was one of several that was used for the Sugiyama Tomb found in one part of the complex, but because of the close proximity of residential homes, it could not be reconstructed on the exact spot, therefore a replica was made in a nearby location and opened to the public.
- The Rajo-mon Gate straddles two administrative areas, and each prepares and erect the information board for visitors.
- The participants were also shown the drafting room, archives, the photo lab and work studio where brief explanations were given of measuring tools and ink rubbings.


The kiln for roof tiles


Lecture by Mr Morishita


Lecture by Mr Nakajima

25 Nov. (Thur.)

■ **Storage and Management of Artefacts** <ISHIMURA Tomo / NNRICP>

- The participants were guided through the repositories rooms: a treasure room→ an artefact storage→ a wooden tablet room → a wooden object room → an aerial photographs storage→ library in the given order and observed the systems used to automatically monitor and control the temperature and humidity.
- The wooden boxes, used to store earthenware and tiles, had been replaced with plastic containers because of the lighter weight, but staff is reconsidering the wooden boxes because the plastics would melt in a fire.
- The separate rooms are used to store wooden artefacts in water prior to conservation treatment and those already conserved, and the computer system is used to record the locations of artefacts.
- In the wooden tablet repository, the treated tablets are stored in drawers made of paulownia wood, and temperature and humidity are kept constant by air-conditioning same as in the aerial photographs repository.

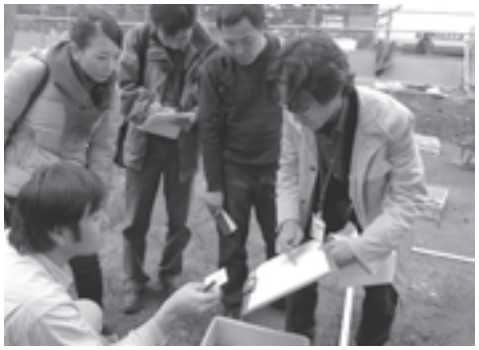

Lecture by Mr Ishimura

- In the library, survey maps, drawings and original reports are stored apart from books, and photographic negatives are kept in air-conditioned archives.

■ **Site Management in Practice** <UNNO Satoshi and ISHIMURA Tomo / NNRICP>

Before visiting sites, a lecture was given on the importance of making and appropriately managing records of sites after research.

- The 447th Nara excavation site of the Kasuga East Pagoda in the grounds of Nara National Museum
  - An outline of the excavation site and remains was explained by Mr Unno. Also, Mr. Ishimura explained how to draw grids, and manage and catalog unearthed artefacts at the excavation site. Questions were raised on the genre and age of remains, excavation period and scale, staff (experts and workers) involved in excavations, etc. Visit to Uwanabe Tomb (Yet to be excavated, preserved or developed).
- Uwanabe Tomb (Not yet being excavated, researched and preserved)
  - Mr. Ishimura gave an overview of the tomb and explained that excavation was not permitted because it is under the jurisdiction of the Imperial Household Agency, hence appearing in its present state.
- Ishi-no-Karato Tomb (Already excavated, preserved and developed)
  - An outline of the site of the eighth century tomb: the background to excavations, preservation and development work.
  - The explanation focused on the need of consideration in site management in relation to urban development, development policy and costs, and management method.
  - This site was designated as National Historic Site after restoration and development, and then turned into a park because of its location in a residential area.
- Onjogatani Kiln sites (Which produced the tiles for the Nara Palace.)
  - An outline was given of the site and development: Mounds and stones on the site showed location of the reconstructed kiln.
  - The participants spoke of kiln sites in Mongolia and their plans to excavate them, and asked if there were sites in Japan where the remains of kilns could be seen.
  - They also asked its positional relationship to the Nara Palace and changes in production sites in the areas. Harima district was specialized in the firing of roof tiles in Middle Ages in Japan.
- Utahime-nishi Kiln
  - Only stones were laid out to identify the location of the kiln.
  - An outline was given of the site and its management.




Lecture by Mr Unno and Mr Ishimura on excavation sites

26 Nov. (Fri.)

■ **Introduction to Dendrochronology** <OKOCHI Takayuki / NNRICP>

- An explanation of how tree rings form every year by using a Japanese cedar as an example.
- Relations between dendrochronology and archeology, climatology, ecology, geomorphology and other related fields. The lecture also covered the origin and history of dendrochronologic studies.
- Skeleton plotting as a method for plotting the width of tree rings; the narrower the ring, the longer the mark in a bar graph.
- Measurement methods used by the NNRICP were introduced, which were initially done with microscopes, but methodologies were improved recently by using computers and digital photos to automatically match ring patterns.
- Introduction of case studies
  - Well framing excavated at Saidai-ji Temple: The tree's age when it was lumbered was pinpointed from bark and sapwood, and matched to documented records.
  - Architectural members of the five-tiered pagoda, main hall and middle gate of Horyu-ji Temple in West precinct: It was revealed that the current Horyu-ji Temple (West Precinct) was rebuilt after the fire of 670 in records.

■ **Introduction to Environmental Archaeology** <YAMAZAKI Takeshi / NNRICP>

- Various analytical techniques used in Environmental Archeology were presented.
- Introduction of sites that contained fauna and flora remains and those remains. What kinds of fauna and flora remains have been uncovered in shell mounds, wetlands and caves, and how they were excavated.
- Precautions in site excavations were noted to observe and record the buried state, bring in experts when necessary, and examine ways to extract buried remains.
- Introduction was sampling methods such as sifting with a sieve, transporting entire blocks of earth back to the lab, provisional reinforcement on-site in the event of fragile state, etc.
- It is preferable to crosscheck as many analyses results as possible.
- The importance of animal skeleton specimens: identifying the samples against reference specimens is indispensable and a large number of samples is necessary in conducting research.
- The participants observed the sample digitizing process using 3D laser measuring equipment so as to post skeletal samples online in the future and also visited the preparation studio and the specimen storage.


Lecture by Mr Okochi


Lecture by Mr Yamazaki


Observation of bones

28 Nov. (Sun.)

■ **ACCU International Seminar 2010**

The participants attended the international seminar, "Archaeology in Mongolia: The Latest Report on Site Investigation" co-organised by ACCU Nara and Nara University. Mr Munkhtulga, one of participants, gave a presentation under the title of "Present Situation and Needs for the Preservation of the Turkic Period Stone Monuments in Mongolia."

29 Nov. (Mon.)

■ **Introduction to Recording/Documentation of Artefacts** <SHIBA Kojiro / NNRICP>

- An explanation of measured drawing methods used in Japan although each country has their own methods; Introduction of tools for measured drawing and their usage.
- Differences in principles and methods between (1) earthenware and wood containers that are drawn as rotating bodies, and (2) stone and metal objects that are drawn from the front, back and sides by third angle orthographic projection.
- A point to note was explained when observing and measuring the various artefacts.

■ **Recording/Documentation of Stone Objects** <SHIBA Kojiro / NNRICP>

- An explanation of what to observe before measuring stone artefacts and measurement methods.
- Using a chipped stone tool as an example, participants observed the context of flake detachments.
- Practical training with instruction of observation points and measurement methods for each step: drawing the contours, adding ridgelines, notations such as surface finishing, measurement of side profiles, making of inverted drawings using tracing paper, etc.

30 Nov. (Tue.)

■ **Recording / Documentation of Roof Tiles** <SEINO Takayuki / NNRICP>

- Outline of Japanese roof tiles: Unearthed tiles often tell whether a site was a temple, a palace, a government office, or a castle. Moreover, because they are mass-produced, tiles make it easier to follow the transitions in technologies and thus serve as a means for identifying the age of a site. As an example, the historical transition of tiles from the Nara Palace of the Nara Period was presented. Especially, eave tiles are useful for pinpointing the age of a site.
- Research of roof tiles: There was two areas of study in roof tiles, which were that of production technique and that of esthetics (quality) seen in design patterns. With regards to this former field, an explanation was given of producing areas, technological transition and product transport, while, for this latter field, research was developed on age and moulds. Using eave tiles unearthed from the Fujiwara Palace and Heijo-kyo Palace sites as examples, explanations were given of the classificatory criteria and cataloging rules used by NNRICP.
- An explanation of the transition in tile fabrication methods. Moreover, it was explained that, when a tile made from the same mould is unearthed in another geographic location, it lends thought to the (1) transport of products, (2) transport of moulds and (3) movement of moulds and mould artisans. It was also explained that (1) and (2) were determined from the clay paste, and (3) from the fabrication method. Furthermore, traces of mould flaws are important towards identifying the distinctive differences in age.
- Methods for cataloging and managing roof tiles: After making annotations on the tiles, ink rubbings are made of eave tiles and other tiles, attached to cards for cataloging, and input into a database for management purposes. This database is equipped with a search engine, which they were shown in action. Ordinary round and flat tiles are weighed zone-by-zone. This is done because the presence of a roofed structure and the type of roof, whether using alternatively overlapping round and flat tiles or a hip-and-gable roof on separate planes, can be surmised from the distribution of tiles. Basically, tile records are made and managed as a combination of rubbings, measured drawings and photographs.
- The basics of measured drawings were explained. Whereas measured drawings are expressed in three dimensions, ink rubbings are planar, but they are easy methods to do once used to it.
- Each participant practiced ink rubbings and compared their rubbings against cataloged tiles.

Ink rubbings of roof tiles

1 Dec. (Wed.)

■ **Recording/Documentation of Earthenware** <NAKAMURA Akiko / NNRICP>

- Introduction to earthenware of Japan: earthenware types and transitions in chronological order, i.e., from origin of earthenware, appearance of kilns in the tumulus period, standardization under the Ritsuyo legal code, to appearance of glazed pottery and porcelain.
- Since most earthenware was for daily use and was not used for long periods of time, and changes in earthenware came often, it is used in archeology as a measure for determining age. Some potteries bear finger-tip impressions from when they were being made.
- Introduction of measuring tools: Usage and precautions.
- The forms obtained with mako play a supplementary role at best while points measured with a caliper are important.
- Scales and calipers affect the accuracy of measurements depending on whether they are horizontally used in measurements or perpendicular to a cross-section.
- To be careful in making measurements so that the characteristics of the earthenware are not lost when images are scaled down.

After hearing an explanation how important is observations prior to measuring earthenware, each participant started taking measurements. First, they worked with integral artefacts. Work proceeded with the instructor providing explanations at each step of the measurement process. Guided by the instructor, they obtained the maximum diameter (mouth of Sue pottery work A) and set the pottery for measuring, then drew its contour using a set square, a divider, a scale and a caliper. Today's work went only as far as drawing the outer shape of the earthenware.




2 Dec. (Thur.)

■ **Recording/Documentation of Earthenware** <NAKAMURA Akiko / NNRICP>

The today's goal was to complete a measured drawing of the earthenware. As with yesterday, Ms Nakamura explained the step-by-step observation points and measurement methods, then the participants took to measuring and completed their cross-sections.

- Adding indications of corrections and final touches on the surface: stroking, scraping, brushing and paddling. The instructor also explained marks in the bottom made by the wire when cutting a pottery from the wheel. Each of the participants completed a measured drawing.
- Hands-on session of measured drawings of earthenware with a pedestal (Sue pottery B) under the guidance of the instructor. They mastered usage of measuring tools and accurately identified measurement points, but they did not adequately understand the external, cross-sectional and internal views, therefore the instructor explained the points in detail.
- During lunch break, they toured the winter exhibit, "Survey, Find and Report: Nara Palace and Cultural Properties" (where the history of surveying and transitions in survey equipment were displayed on panels and real equipment) at the Nara Palace Site Museum.



3 Dec. (Fri.)

■ **Recording/Documentation of Earthenware** <NAKAMURA Akiko / NNRICP>

Measurement continued in accordance with explanations from the instructor given on the days before.

- How to make measured drawings from shards (how to obtain the radius of an arched shard from the intersection of perpendicular bisectors with compasses).
- What part of a shard is measured to get the cross-section? The basic rule is to closely examine the shard and identify the point where the cross-section is the longest, but consideration must be shown to map as much of the external and internal views as possible.
- An explanation on how to make inverted drawings using tracing paper.
- How to measure asymmetric earthenware such as Sue ware flat jugs, by showing measured drawings.

■ **Conservation Science for Sites and Artefacts** <WAKIYA Soichiro / NNRICP>

- The fundamental concept on the deterioration and conservation of cultural properties was explained. All cultural properties deteriorate although there are varying degrees. Conservation treatment cannot stop the deterioration but can slow its process. Accordingly, artefacts must be monitored carefully after undergoing treatment.
- Conservation treatments for metal artefacts
  - In regards to archaeology, conservation sciences started with temporary measures taken at

excavation sites. That is to say, when unearthing brittle artefacts such as metal objects, it should be first temporary reinforced with acrylic resin before removing from the ground.

- It is necessary to know the internal state of artefacts: X-ray radiography and X-ray computed tomography were introduced.
- Cleaning is divided into two steps: physical cleaning and chemical cleaning.

- Conservation treatments for wooden artefacts
  - Good environment for preserving wood are wet (water-logged), extremely dry (desert) and frozen (tundra, frozen ground)
  - Most wooden artefacts in good condition in Japan are excavated in water-logged, therefore explanations focused on conservation treatments for wood uncovered from wet environments.
  - The basic procedures are to replace contained water with PEG (artefact is placed in a tank where PEG content is gradually raised), or vacuum freeze-dry method.
- Conservation treatment for stone objects
  - The Moai statues (made of tuff) of Easter Island were given as an example.
  - The hardness of the stone was examined and then the stone was reinforced by injecting the same silicic acid found as a primary component in the stone. Also, water repelling treatment was done to prevent erosion by rain.
  - To piece together broken stone monuments, epoxy resin is used, but in some cases, stainless steel rods are embedded to hold pieces together.
- Transcription of stratigraphy
  - How to transfer soil strata using urethane resin: surface clearing → resin coating → backing for reinforcement → resin coating → drying and stripping
- A question was asked on how to preserve bones; the most critical point is how bone are unearthed. As long as temporary reinforcement with resin is done at the site, the bones can be removed and later treated at the laboratory. In general, resin may affect analytical results, so careful attention is needed.

6 Dec. (Mon.)

■ On-site Lecture: Historic Monuments of Ancient Kyoto

● Kiyomizu-dera Temple

Prior to visiting Kiyomizu-dera Temple, an explanation was given of how the layouts of the temples and sanctuaries that the participants had seen in Nara completely differ from Kiyomizu-dera Temple, which was built into the hillside. That was followed by an overview of the Nio-mon Gate (Important Cultural Property, built in the Muromachi Period with a hipped and gabled roof in cypress bark) and the guardian warrior statues of the late Kamakura Period on the left and right of the façade. After that, they were told about the overhang architecture of the west gate (Important Cultural Property), three-tier pagoda and main hall (National Treasure) and stage architecture, which they then viewed. After viewing the inner sanctuary (Important Cultural Property), they observed the actual overhang architecture of the main hall.

● Kinkaku-ji Temple

An explanation about the Kitayama culture (from late 14th century to early 15th century) and the Higashiyama culture (mid 15th century) of the Muromachi Period: the positional relationship of Kitayama and Higashiyama, as well as the Muromachi Period, and a comparison between Kinkaku-ji (Rokuon-ji) Temple and Ginkaku-ji (Jisho-ji) Temple. Kinkaku-ji Temple was designed as a garden with walking paths around a pond, but visitors could only go halfway around the pond.

● Ryoan-ji Temple

The courtyard in front of the priests' chambers (Historical Site and Scenic Landscape) is famous for Zen dry landscape garden. It contrasts strongly with the gold leaf temple and is one of World Heritage sites. There is otherwise a garden around Kyoyochi Pond, which is designed for strolling, which they did.


Kiyomizu-dera Temple


Kinkaku-ji Temple

7 Dec. (Wed.)

■ Research Method for Artefact / Facility Tour of Nara University <NISHIYAMA Yoichi / Nara University>

- An outline of Nara University was given. The university was founded in 1969 and the Department of Study of Cultural Properties, for which the university is known, was created in 1979 as the first department focused on cultural properties of any university in Japan. It is organized with departments in the fields of Archeology, Art History, Conservation Science, World Heritages Studies, Cultural Properties and Museum Studies, and Historical Records. Cultural properties studies are interdisciplinary so that preservation sciences are looked at from the perspective of archeology, art, folklore, historical records, etc. An example of site restoration in Lebanon was presented to describe activities.

- The instructor asked them if cultural properties in Mongolia have been affected by air pollution, to which they responded that investigations had not addressed air pollution but the affects of climate.
- Visiting a class of practical training in conservation sciences: rust being removed from ironware and pieces being rejoined.
- Visiting the archeology lab: earthenware used for practicing measurements, electronic microscope, fluorescent X-ray analyzer, X-ray diffraction analyzer and other equipment.
- Visiting the library: A guided tour of the "Understanding Differing Cultures in the Age of Great Navigation – Central Focus on the Archives of the Hakluyt Society" exhibit that was currently ongoing.

After that, they toured the library by themselves and asked whether anyone could use the library, as well as about future plans to purchase literatures, the number of books in the collection, and check-out period. Then, they individually read literature of cultural properties and took notes.



At Nara University

8 Dec. (Wed.)

■ **Study Tour: Site Management and Utilisation in Practice** <NAGASAKI Hiroshi / Saga Pref.>

- An explanation about zoning for park development especially on main historical settlements at the Yoshinogari Historical Park.
- An outline was given of the Yoshinogari Historical Park project, promoted by both the state and Saga Prefecture, the basic policy is to restore the original landscape and to reconstruct structures on the mound of 0.5 to 2.0 meters as a means for preserving the site.
- At the museum, while viewing artefacts and panels, the participants learned the background to excavations of the Yoshinogari site, the park development project after being designated as a historic site, and transitions of the site and burial jars peculiar to the northern end of Kyushu.
- They walked to the Southern Inner Enclosure and climbed the watchtower there to view the entire site; the ceremonial hall in the Northern Inner Enclosure; and the dioramas on the second and third floors for a gathering and rituals.
- It was explained that the rows of burial jars in the northern end of the Northern Inner Enclosure were a practice that started in the mid Yayoi Period about the same time as the burial mounds also found in the northern end of the site.
- In the Northern Burial Mounds area, the layout and jars are original, but they have been covered to keep temperature and humidity constant.




At Yoshinogari Historical Park

- An explanation on the group of burial jars seen earlier and the hierarchical differentiation of the jars and grave goods found in the burial mounds.
- They also toured the excavation site of the burial jars and observed the rows of burial jars arrayed in the north-south direction, the row of jars diagonal to that, how they were buried and the clay seals of the jars.

9 Dec. (Thur.)

■ **Study Tour: Site Management and Utilisation in Practice / Museum Visit** <AKASHI Yoshihiko and IMAZU Setsuo / Fukuoka Pref.>

● An overview of Kyushu National Museum

- Different from other museums, it offers a guided backyard tour around conservation laboratories, restoration studios and repository to visitors based on the theme of "it is not a museum if it does not attract your interest."
- Exhibits are arranged as a comparison and study of cultures in Japan and other parts of Asia. However, the museum's own collection is small and many of the displayed works are on loan from shrines and temples.
- Special exhibitions are held four times a year and the permanent exhibition on cultural exchange in their main galleries is regularly updated. As of this year, they are running special exhibitions under joint themes with the Bangkok National Museum in Thailand from January 2011.

● Backyard tour

- The building was built to protect exhibits against changes in the weather. It has a dual structure of framework and jacket, and double-pane windows. The passages are located around the repository, and the laboratories are located outside from there. A nitrogen gas injection system is provided as a fire prevention measure.
- An explanation of how data obtained with the 3D digitizer in the restoration studio is used (measured drawings, making replicas, making stands to stabilize artefacts by inverting data, etc.).
- The functions and features of the CT scanner used to see inside of artefacts were explained at the studio. Participants observed restoration of Japanese paintings and insect-damaged documents and the traditional paper-making procedures used for that.

● Cultural Exchange Exhibition

- The main exhibition consists of five era-centric exhibits, the fourth of which starts from the Mongolian Empire. On display are mooring stones from the Mongolian Invasion and earthenware retrieved from the sea floor.
- There are eleven exhibitions with themes around the gallery, which are changed out from time to time. After getting an outline of the exhibition related to Mongolia, they observed the exhibitions on their own.

During lunch, Mr Kobayashi, Head of Data Management Section, asked about Mongolia. He took part in a workshop in Mongolia in October in preparation for the opening of the Kharakhorum Museum. He was worried that there were not enough artefacts to exhibit. The participants responded that a request

for exhibits had been made to the Institute of Archeology of the Mongolian Academy of Sciences and arrangements were underway to loan artefacts to the museum.

● Dazaifu Government Site
- An outline of the Dazaifu government and the history of site preservation.
- Participants learned positional relationships of the governmental compound, moats, Ono Castle, Kii Castle and other landmarks while looking at a topographical model of the local area, and also learned about the utilisation of geographic advantage in their defenses.

● The Kuranotsukasa area where foundation stones marked where storehouses once stood.
- The layout of the foundation stones were used as evidence of a storehouse once stood on this site.

● Mizuki (moat) Site
- The size and structure of the moat; the origin of a term “mizuki” (literally meaning “water castle” but meant to describe a moat) and the role of moats back in the day.

● Ono-jo Castle
- The castle sits inside a bowl atop a hill and the castle walls were built on the tall ridge around it.
- The participants walked around the long stone rampart → Obana area → Dazaifuguchi-jomon Gate.

● Dazaifu Tenman-gu Shrine
- A story on the origin of Tenman-gu Shrine and benefits of the shrine that worshipers seek here.
- After that, they toured the precincts on their own.

10 Dec. (Fri.)

■ **Study Tour: Site Management and Utilisation in Practice** <IKEZAKI Joji, TAGAMI Yuichiro and RIKITAKE Takuji / Fukuoka Pref.>

● Fukuoka City Archeology Center
- The features of the Archeology Center were explained. Unlike similar organisations in other municipalities, the municipal Cultural Properties Department of Fukuoka City conducts excavations and, once a report has been published, the unearthed artefacts are registered, managed and stored at the Archeology Center. Preservation treatment is done as necessary, and artefacts are exhibited to the general public and otherwise used. Currently, they have about 100,000 boxes of artefacts and the amount is increasing by about 5,000 to 6,000 boxes a year. The columns of the repository are thick so that additional stories can be added to the building.
- The exhibits are not in chronological order but instead introduce the work of the Archeology Center, so the displays follow the work flow of excavation, preservation treatment, restoration, storage and management.
- Exhibits focus a spotlight on the local country of Nakoku (from the first to third century) that

highlighted the Fukuoka area the Yayoi Period and the Hakata capital of the middle ages.

- The library is open to the general public and anyone can use it.
- The repository is divided into sections for earthenware, stone artefacts, roof tiles, wooden artefacts that require temperature and humidity control, and metal artefacts.
- In the radiographic room, the participants received an explanation about the types of analyses that are possible with the equipment (radiographic opacity system, fluorescent X-ray analyzer, X-ray diffraction analyzer, etc.) used for preliminary studies prior to conservation treatment.
- Visiting on the metal artefact conservation studio, wooden artefacts storage room and conservation treatment with PEG solution.
- A special repository where temperature and humidity are controlled. A window is provided for backyard tours and some artefacts that had already been preserved were on display.
- The records repository houses photographs, artefact ledgers, and drawings; digitizing all of these paper media are currently proceeded.
- Answering the request of the participants, bones (without conservation treatment) taken from a burial jar were shown to them at the special repository.

● Site Management and Utilisation

- At the Kanenokuma Site, unearthed burial jars are on display. Both the jars and the bones are the originals. It was explained that the site has greatly helped to date the jars because the jars have been piled in layers over a long period of time, and the bones are in good condition.
- At the Itazuke Site, the participants received an explanation of the site in front of a reconstructed model on display at the Itazuke Yayoi Museum. The museum is designed for hands-on learning, where visitors can experience what it was like to work in the Yayoi period using replicas of farm tools, etc. All three participants tried the tools. After that, they went to the developed site and saw what a village looked like in the early Yayoi Period.

● Genko Defenses

Of the few defenses remaining in Genko (the Mongolian invasions of Japan in 1274 and 1281), the participants visited the ones restored in Ikinomatsubara area.



13 Dec. (Mon.)

■ **Photography of Site and Artefact** <SUGIMOTO Kazuki / NNRICP>

The session began with questions by Mr Sugimoto on the photographs in Mongolia: whether pictures in archaeological reports were taken by a digital or film camera and how that data was managed. All pictures are taken with digital cameras in Mongolia.

- Explanations of the fundamentals of photograph (mechanisms and principles) were given using a film camera (4 x 5 view camera), and the participants were to apply that to digital cameras.
- What is aimed for photographs of cultural properties and what needs to be done.
- After explanations of film sizes, negatives and positives, participants verified the amount of information by film size using 35 mm and 8 x 10 cameras as examples.
- The principles of a camera were explained by using a 4 x 5 view camera.
- Explanations were given on the types of lenses (telephoto, standard and wide-angle), focal distance and lens aberrations; the relationship of film ISO was explained alongside metering adjustments via the aperture and shutter speed; the relationship of aperture to depth of field, that is to say, the principle of stopping down the aperture to deepen the field of view.
- Using a view camera, they saw for themselves the differences in the depth of field when looking at a jar and changing the aperture. When actually taking pictures, the aperture was determined from the depth of field and the shutter speed was set using an exposure meter. In short, it was explained that aperture was prioritized in shooting cultural properties.
- The color temperature of the light source affects the reproducibility of the film. For example, using daylight film under a tungsten lamp renders a yellowish finish, whereas, under clear skies, images are bluish.

14 Dec. (Tue.)

■ **Photography of Site and Artefact** <SUGIMOTO Kazuki / NNRICP>

- The purpose of photographing cultural properties is to faithfully record those that are in danger of being lost. For that reason, photographs must contain as much information as possible.
- Review of the key points: relationships of ISO, aperture and shutter speed.
- Photographing artefacts: Setting and lighting
  - Platform: Usually a height of 1 to 1.2 m, excluding bird's eye view shots.
  - Background paper: White is the basic color and convenient because it does not affect the object when shooting or printing. However, other colors are used for posters, pictorial records, etc. The object is set so as not to cast background shadows and the background paper is not folded because

of the differing reflections that can result.

- Lighting: The lighting position and reflector board should be positioned to bring out the maximum information from the object. Shadows can be reduced by diffusing light with a diffuser.

- The instructor demonstrated how to set up an object using two light sources, diffuser and reflector board. A gray scale was added to the shot and used to adjust color. The participants asked many questions specifically on practical techniques.
- An explanation on the principle (shadow-less) of bird's eye view shots. The background is white and lighting is provided by one main source and auxiliary source using deflector boards (indirect lighting reduces unevenness in the background).
- Practical training in bird's eye view shots was done with a 4 x 5 view camera and flash. Each participant focused on the object and confirmed the depth of field via the aperture, and the instructor measured the amount of light with an exposure meter, adjusted the strength of the flash and set the aperture and shutter speed. Each participant took Polaroid shots of earthenware shards and stone artefacts.
- Outdoor photography was practiced with a 4 x 5 field camera. Everyone took pictures of each other with a Polaroid.



15 Dec. (Wed.)

■ Writing Final Report

The participants prepared their reports of the training programme.

16 Dec. (Thur.)

■ Closing Ceremony

The participants submitted their reports and a closing ceremony was held. Mr Nishimura, Director of ACCU Nara, awarded a certificate of completion with a word of appreciation for their hard work and wished they would impart their knowledge and experience to their colleagues and friends in Mongolia. Then Mr Bayarsaikhan addressed a short speech and expressed his gratitude toward lecturers and ACCU Nara on behalf of the participants.


The closing ceremony

III. Participants' Country Reports

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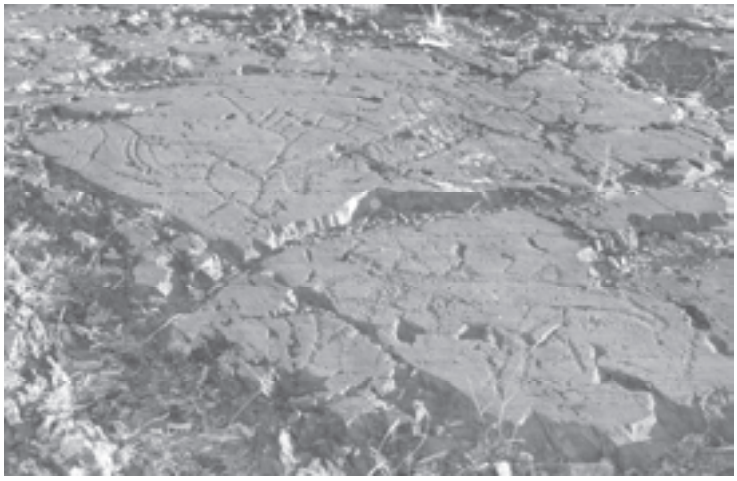
Preservation and Protection of Cave Paintings in Mongolian Altai Mountain Range

Introduction

Aral Tolgoi, Shiveet Khairkhan in Tsengel sum of Bayan-Ulgii aimag and Tsagaan Salaa, Baga Oigor cover the most of Mongolian Altai mountain range and they are very rich of cave paintings remains.

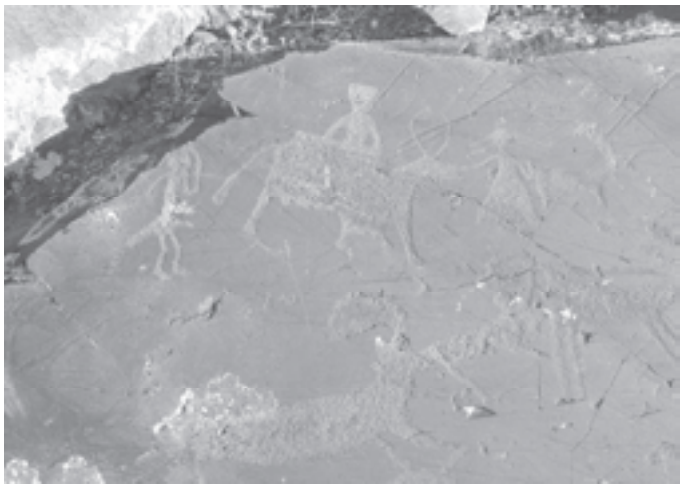
Aral Tolgoi cave painting site is situated in Khoton and Khurgan lake valley, between Khar Salaa and Rashaan rivers. This place is one of the beautiful natural places in Mongolia. Most of the Aral Tolgoi cave paintings, which are 90 percent of the paintings, are about wild animals and hunting and only 7 percent of them is about farming. It is obvious that Aral Tolgoi cave paintings are remains made by hunters. The most ancient cave paintings of the place are composition with big ostrich and horse, paintings of deer, ox etc and some paintings are left unfinished. The main part of Aral Tolgoi cave paintings is wonderful remains of the middle, the late Stone Ages and the Bronze Age.



Aral Tolgoi cave painting

Shiveet Khairkhan cave painting site is situated not far from meeting of Khar Salaa and Tsagaan Salaa rivers where begins running Tsagaan Gol which is left branch of the biggest river in Mongolian Altai – Khovd river. Shiveet Khairkhan complex consists of thousands of cave paintings and while situated between Khar Salaa and Tsagaan Salaa rivers it is officially considered one of the biggest centers of

cave painting arts in Central Asia. Shiveet Khairkhan cave paintings were made by ancient hunters and herders. Paintings of the complex were drawn by Mongolian Altai habitants between the early Bronze Age and the time of ancient Turkish period. Most of the paintings are made in the Bronze Age and the early Iron Age. Most of the paintings show the hunters chasing after wild goats and deer; people fighting in a war; several legendary animals; deer, ox, beast body, horn, various seals and carts.



Shiveet Khairkhan cave painting

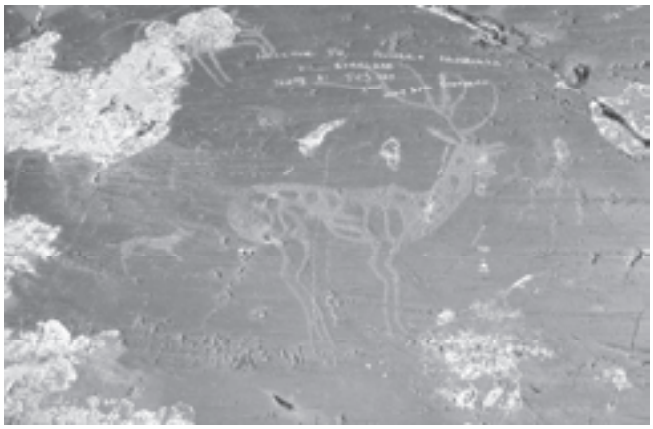
Tsagaan Salaa and Baga Oigor cave painting site contains not only cave paintings, but also it has other archeological remains such as mounds, graves, stone monuments, sacrifice facilities which are remains between the late Stone Age and late Middle Age. Cave painting are carved on the surface of 2000 rocks sticking out of the ground. Each boulder has about 1-180 cave paintings carved on it and based on calculation the complex is supposed to have 75,000 – 100,000 paintings. Tsagaan Salaa cave paintings are the most ancient and unique remains and they were drawn in the late Stone Age (6000 – 3000 BC) and in the Bronze Age (3000 – 1000 BC) by habitants of Mongolia who changed their lifestyle from ancient hunting to farming and started their classic nomadic farming.

Research

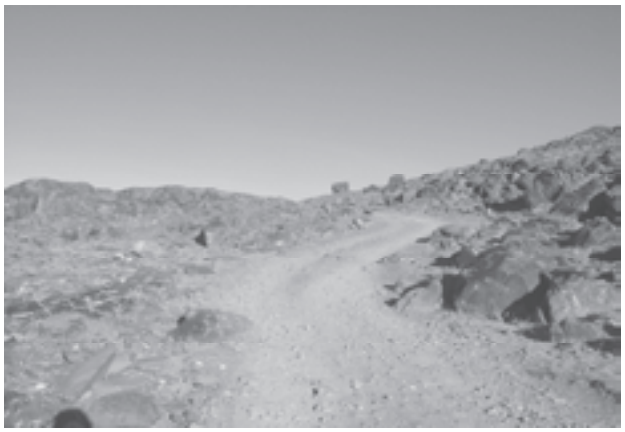
Tsagaan Salaa, Baga Oigor cave painting singularities were discovered first in 1979 by archeologist D. Tseveendorj and in 1994 in the framework of Mongolian-Russian-American joint project Altai there were research which concluded that Tsagaan Salaa, Baga Oigor cave painting complex place is the most biggest remain in Mongolia by territorial coverings. There were two new cave painting remains newly discovered that time: Aral Tolgoi, Shiveet Khairkhan. There were published 6 volumes of 4 monographs in France, Russian Federation, Mongolia written by doctor, professor D. Tseveendorj, V. D. Kubarev, E. Jacobson using the results of many years' research in Mongolian Altai.

Present status of cave painting protection

Some of Aral Tolgoi, Shiveet Khairkhan, Tsagaan Salaa, Baga Oigor cave paintings were damaged due to aging and severe climate conditions and rather faded. Except natural effects there are human elements which have negatively influences to integrity of the remains. Till now no one has paid attention to these paintings on rocks. Religion and tradition positively influenced to people nearby. Recent impact of regional habitants, pads of sheep, goats, ox and horses make cave paintings disappear and some ancient paintings of animals such as mammoth, buffalo and hind are fading. Also we need to stop using old techniques of scientific research which includes cleaning the rock surface and draw or scratch various things on the surface to round out the paintings. Cleaning scabs on the surface of rocks make process of determining the painting ages more difficult. Many herders are building winter and spring camps which increase environmental pollution in the area. They also raise a amount of stocks beyond the grassland capacity and botanical coverings deteriorate more and more.



Scratches on Shiveet Khairkhan cave paintings



Cave paintings on a roadside

There are many remains of several archeological time periods discovered in Aral Tolgoi, Shiveet Khairkhan, Tsagaan Salaa, Baga-Oigor river valley except cave painting remains. Currently the research was concerned only on cave paintings and other remains were researched less, however there were no conservation works done.

Urgent works to do to preserve and protect cave paintings

There are no annotators, guides, special road markings in Aral Tolgoi, Shiveet khairkhan, Tsagaan Salaa, Baga Oigor site. There is a strong need to set up a site introduction, notations, markings to show tourists.

There are many cases when information given to tourists by museum or other organizations was not updated and skipped the main part.

Urgent issues which need solutions are shown below:

- Create a museum for public on the cave painting site.
- Preserve pristine nature, conserve current conditions, and don’t make any changes to its original state.
- Don’t scratch and write anything on rock paintings in the caves.
- Don’t allow people stepping on and cattle pacing near a place of some fading cave paintings.
- Some cave painting areas need fences around them before they completely disappear.

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Monuments and Remains Erected at the Time of Turkish State in Mongolian Territory: Problems of Their Conservation, Protection and Actual Problems

When Mongolian archeologists divide periods of archeological artifacts before mid of last century, they usually use the name of dynasty which was established and collapsed on given territory as basis. The divisions of periods are shown below as follows:

Ancient period
- Huns (3rd BC - 2nd century AD)
- Xianbei (2nd - 3rd century AD)
- Nirun (5th - 6th century AD)

Middle Age period
- Early Middle Age period
  - Turkic Kaganate (6th - 8th century AD)
  - Uyghur (8th - 9th century AD)
  - Khitan (9th - 12th century AD)
- Late Middle Age period
  - Mongol (13th - 15th century AD)
  - Manchu Qing (17th - beginning of 20th century AD)

The author works in Middle Age archeology department of Archeology Institute of the Mongolian Academy of Sciences and the research is concerned with Middle Age archeological artifacts. In this report, I will briefly introduce various monuments and remains erected at the time of Turkish period in Mongolian territory using materials collected by myself since 2003 during field research projects. Also I will explain about causes of artifact damage, conservation and protection status of artifacts with examples and give my proposals to improve current status.

The best conserved and the most numerous human cultural remains from early Middle Age (6th - 12th centuries) in Mongolian territory are monuments erected at the time of Turkish period.

Kinds of monuments erected at the time of Turkish period are:

- stone monument in human shape
- stone fence

- Balbal
- shining monument
- shining monument base
- construction column base
- rectangle stone with a hole
- stone monument in animal shape etc.

These comprise Turk's Khan and royal family monument complex. The most of the khan and royal family's monument complexes are situated in Mongolian territory and they usually found in big rivers embankments or nearby plateau.

If the complex's owner's social status was low, there were few kinds and number of remains. For example, Bilge Khan's monument complex, which was built in 735 and currently the best researched among monuments of Turk's khans and royal members, has all the monument kinds listed above but other royal members with social status lower than khan has smaller monument complex containing much lesser kinds, in size and number of monuments.

The smallest complexes have only stone fence and Balbal. We have determined that the bigger complex is for Khan spirit but we don't know yet for whom was built the smaller complex, for a royal member with lower social status or for a Rag-rag. Chinese historical scripts say that Turk's government men can have one of 28 levels. Nevertheless Turk's royal member's places show the social status differences between government officials at that time.

In the monument site, there are owner and his surrounding made from stone; their age, gender, social status are clearly shown by their clothes, weapons and tools, decoration, sitting, hands and foot location. Therefore stone monuments in human shape are used as sources for comparing written information sources with other materials discovered in archeological excavations. Stone monuments in human shape are usually built on the left side of stone fence and its face directed to sunrise. Depending on owner's social status there can be from two to several dozen stone monuments in human shape in a site.

On the right side of stone monument in human shape or Balbal there is a box-shaped construction built with four plain stones and filled with small stones in it. Plain stones are polished and decorated with engraved wall pattern, patterns with animal and plant. Some plain stones have on its edges ancient Turkish (Runic) writings and seals. Also there are some plain stones in the center of its surface engraved human figure.
There were found many long stones placed one after another in one row beginning from stone monument in human shape and directed to south east and they are named in Turkish writings as "Balbal". Balbals seem to be usual stones but their amount, size and design show the owner's social status, power and blood.

First stone in Balbal row of influential royal members can be considered as stone monument in human shape. Some Balbal has on its surface ancient Turkish writings and seal engraved. By Turkish customs, the khan's or prince's grave site must have a place of worship which has on its east side a shining monument with writings about decedent's blood, business, ideology, feats in Turkish, Chinese, Indian, Uighur language on stone base engraved on its surface turtle figure. In some situation shining monument stone base with turtle engravings have also writings and seals.

Shining monuments, monument base, plain stones, and writings on Balbal stone of Turkish state time are nomadic writing culture heritage. Most of the historic materials of Central Asian nomadic people around 6th to 8th centuries are written in Chinese, Uighur, Arabian, Greece languages and remains written on Turkish khan, royal family monument site in Mongolian territory are unique materials which are written by their own hands with their customs, skills and valuable historical information.

Central Asian ancient nomads made their monuments with strong and elegant stones which can resist for long periods in spite of severe natural conditions. Most of the monuments are made of granite, sometimes marble, sand-rock, shale and trap. There are steady granitic monuments which are broken but also there are soft marble monuments which are still unbroken.

Let me show damages occurred to monuments of Turkish period with some examples.

1. Khar Uzuur sacrifice place is going to become dump

Regional habitants threw garbages near one of the two places of Turkish Khan in Zuunbayan-Ulaan sum of Uvurkhangai aimag [Picture 1].

Picture 1: Khar Uzuur monument site which became dump (Mongolian-Japanese "Bichees-2" joint project's field research group)

2. Scattered monuments of Shiveet Ulaan

There are stone piles, stone monuments in human face, and stone monuments in animal figure, shining monument bases within Shiveet Ulaan monument complex on the north coast of Khanui river which is between Khairkhan sum of Arkhangai aimag and Bayan-Agt sum of Bulgan aimag. Some of the stone monuments in animal figure, stone monuments in human face are now "situated" outside of the Orkhon Aimag Museum. Also a stone monument in human face, one stone lion, one stone sheep, one stone monument like a vase are "situated" at Kharikhan sum cultural center, and a monument with a seal is "situated" in Khaikhan sum's temple yard. Someone broke by dropping the stone lion on a bottom floor at sum cultural center several years ago while moving it [Picture 2]. The monument with seal at sum's temple yard used to socket into stone base at Shiveet Ulaan. That is a shining monument of Turkish state with many of its clan's tribe royal seals. There's no other artifact of this kind discovered in our country and in other countries.

Picture 2: Stone lion with broken head "situated" outside of Khairkhan Sum cultural center (2007. Mongolian-Japanese "Bichees-2" joint project's field research group)

The monument is placed its face upside as a pray podium and this great artifact is polished by prayers' body everyday that seals made 1,300 years ago are to be erased soon [Picture 3]. Only one of the stone monuments in human face at Shiveet Ulaan had head but several years ago its head was cut and stolen by Kazakhstan researcher S. Kharjaubai and placed in city Astana.

3. Ongi river artifact

There is a Turkish khan's site with shining monument, stone turtle base, plain stone with ornament, five stone monuments in human face, stone monuments in animal figure, Balbal stone, earthen dam and a canal at a place named Maanitiin Burd in Uyanga sum of Uvurkhangai Aimag [Picture 9]. When it was discovered in 1891, its monuments were broken but the shining monument was in a good condition [Picture 4]. However it was almost unbroken at that time during documentation by photos and moulds now the shining monument was broken, some pieces of it lost. Now there are three pieces at Uvurkhangai Aimag museum [Picture 5]. A mountain goat figure in tribal seal which was on the head of the shining monument was broken and pieces were at that place [Picture 6, 7] .

There are several Balbal stones with seals and it is clear that at least one of them has Turkish writings and seal engraved on from 1891 documentation [Picture 8]. When we came during Mongolian-Japanese "Bichees-2" joint project 2007 the Balbal stone with writing and seal was disappeared.

Picture 3: Shining monument which became prayer's podium (2007)

Picture 4: Ongi river shining monument in 1891 (Russian Empire Geographical Society field research group)

Picture 5: Ongi river shining monument in 2008 (Mongolian-Japanese “Bichees-2” joint project field research group)

Picture 6: Head of the shining monument in 1996 (Mongolian-Japanese “Bichees-1” joint project field research group)

Picture 7: Head of the shining monument in 2007 (Mongolian-Japanese “Bichees-2” joint project field research group)

Picture 8: Disappeared Balbal stone with writings and seal (1891. Russian Empire Geographical Society field research group)

Picture 9: Ongi river artifacts in 2007 (Mongolian-Japanese “Bichees-2” joint project field research group)

4. Robbed sacrifice place at Olonnuur Valley

There is a Turkish royal member monument complex with plain stone with ornaments and writings, stone fence cover, stone monument in human face, Balbal stone in Multiple Lake Valley in Galuut sum of Bayankhongor Aimag [Picture 10].

Mongols were nomadic herders therefore we prohibit excavation till recent time. Since in 1994 "Gold" project put into effect in Mongolia, till now several hundreds of foreign investing companies are mining gold. Besides, unemployed regional habitants started to illegally dig the ground for gold. They always carry their green pot used for washing earth with gold on their back which caused people to call them "Ninja" because they look like heroes of famous "Teenage Mutant Ninja Turtles" cartoon.

Because of several years of dry and heavy snowfall, thousands of herders became "ninjas". Especially most of the habitants near gold mine made their living by digging ground. In the beginning "ninjas" were only digging for gold but after several years they started to dig and rob ancient tombs, sacrifice places, temples and ruins.

Picture 10: Olonnuur monument place's fence (2008)

Picture 11: Tunnel door dug-out by "ninja-style" around the fence (2008)

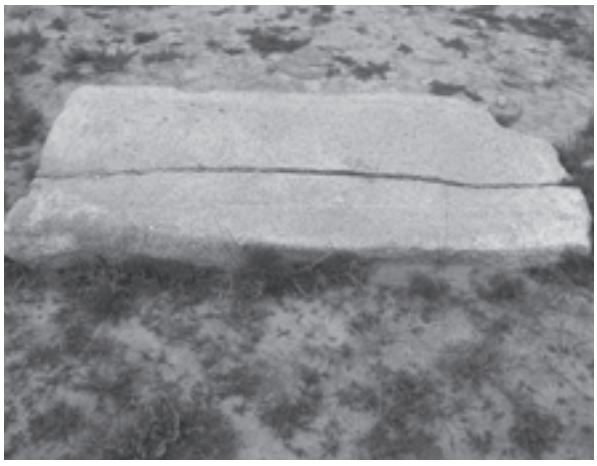
Picture 12: In 2005, robbers burned horse dung to defrost soil and make this burn marks on the face stone. (2008)

Picture 13: South east stone of fence (2008)

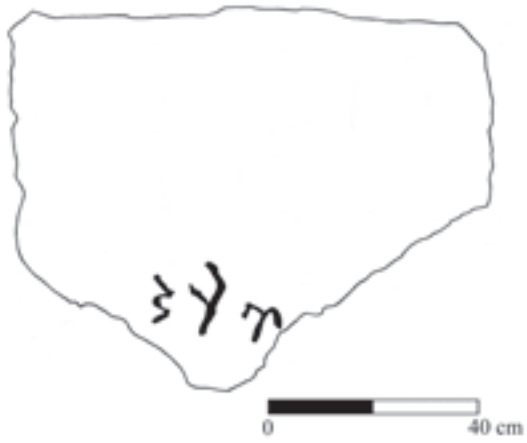
In 2005, people searching for profit dug at the center of Multiple Lake Valley sacrifice place plain stone, and made a well and a cavity around the fence [Picture 11]. While digging they burned horse dung to defrost soil which made burn marks on a plain stone [Picture 12]. That kind of digging which makes well is one of the usual methods of "ninjas".

In June 2008, a research group of Middle Age Department of Archeological Institute of MAS first worked at that place.

In the end of July 2010, when author came to the place someone broke a plain stone which was in good condition while trying to move it with some engine [Picture 13, 14]. Also a plain stone with writings has disappeared [Picture 15]. There is no other artifact discovered yet, its granitic monuments became fragile and it needs immediate preservation in dedicated place, restoration.



Picture 14: South east stone of fence (2010)



Picture 15: Stone cover of fence (2008)

Picture 16: "Snowman" of Tsenkhermandal (2008)

5. "Snowman" of Tsenkhermandal

Someone primitively drew with gray oil paint eyes, eyebrows, mouth, nose on face, buttons on chest of a stone monument in human face in center of Tsenkhermandal sum of Khentii aimag near Governor's Office [Picture 16].

6. "Script" turtle of Tsetsuukhei

There is a sacrifice place of a Turkish khan on the west of Tsetsuukhei river in Ikh-Uul sum of Zavkhan Aimag. The sacrifice place has many Balbal stones, sacrifice temple remain, canal and a stone base which shows there were a shining monument. In 2004 students of historical department of a university scratched some words on the stone base with turtle. Words "2004 ТУУХ I АНГИ" carved deeply in capital letters by something very sharp, metal object [Picture 17].

7. Kul-Tegin monument with unclear scripts

Kul-Tegin monument was built in 732 for the Turkish prince Kul-Tegin and it is biggest and relatively complete with inscriptions in ancient Turkish (runic) language. Till 2000, the inscription was readable from several foot distances, but in 2000, Turkish specialists, Sait Basharan and Juksel Dede, did "restoration" treatment on it and the inscription was severely damaged. They polished the monument surface too much for several days and the script was almost destroyed.

Picture 17: "Script" turtle of Tsetsuukhei (2006. Mongolian-Japanese joint "Bichees-2" project's field research group)

Restoration work for about 1,000 ancient temples started in the 1990s in Mongolia, but only a few of them were done by conservation specialists with international standards. In most cases, they immediately built a new construction on an old temple's base. Also there were many robbers searching for altars and treasures who dug and destroyed old buildings basements. Researchers discovered that temples' walls, forts and column base built between end of 16th century and beginning of 20th century recycled fence stone parts built at the time of ancient Turkish (Mongolian Empire) in their construction of shining monument,. For example Mongolian Japanese joint "Bichees-2" projects' research group discovered in 2007 a fence stone of 7th to 8th century sacrifice place in a temple basement built in 18th century.

Therefore, before beginning a temple restoration work, one should do excavation research and documentation works in an old basement. Placing an information board of the site will be useful for regional habitants, tourists and passengers to understand the history and importance of the monument and it also calls for them to protect and care about it. Boards placed near monuments are getting deteriorated through time due to harsh climate condition in Mongolia. It is observed that stone board of Ungut complex in Altanbulag sum of Tuv Aimag and stone column showing that Tonyukuk sacrifice complex is historical and cultural artifact in Erdene sum of Tuv Aimag had less deterioration in spite of a long time period. One of the effective methods protecting monuments and artifacts from human and animal

Picture 18: Bulgan, Mogod, Khul Asgat's rtifact (2008. Mongolian-Japanese joint "Bichees-2" project's field research group)

iimpact is building an iron fences around them [Picture 18].

One of the Turkish monument complex is a Balbal stone row and its length was from several meters to several kilometers, so sometimes a new road construction work intersects with it and its stones are moved; dropped to another place; used in building fences; or scratched by animals. Therefore, even if it is not applicable to whole Balbal stone row, the part which contains seals and inscriptions should be protected by fences and a new road planning should detour around the site. Because of last years' desertification, some Balbal stones fell from its place and got buried in the sand. Also, regional habitants tended to use fallen Balbal stones for their household purposes.

We should collect and preserve monuments and artifacts in one place. Legal environment for cultural heritage preservation, protection and restoration in Mongolia is not perfect; its provisions and articles are not clear and poorly described; and to brief the law needs to be improved. We need to adopt and apply a new restoration standard on monument and artifact. To use inappropriate methods and tools; to apply nonstandard restoration work by using glue, purifier, stabilizers and other chemicals not introduced and checked in our practice, mean destroying our important cultural heritage irrecoverably. It is clear that the Mongol follows their ancient traditional way of thinking and customs, which include honoring their history, ancestors, nature and earth, and preserving the monuments and artifacts in Mongolian territory.

In the past, Mongolian people usually get off horses and walk to honor the monuments and artifacts when they approached them. However, their sense of ethics and values has changed and they declared that natural resources mining is the only gateway to successful development for the country, so establishment of legal systems for preservation and protection of cultural heritage from the scratch is urgent social problem. In one word, monuments and artifacts are being destroyed in every minute and they need to be rescued immediately.

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Preservation and Protection of Mongolian Remains from the Stone Age

The territory of Mongolia is very rich and full of remains of prehistoric people from the Stone Age. It is said that the research of the Stone Age remains in Mongolia started between the end of the 19th century and the beginning of the 20th century. However, the scientific research of remains of the Stone Age in the territory of Mongolia started around the end of World War II, mainly in 1949. Since that time, a Mongolian-Russian joint expedition of historians and ethnographers researched and explored through the Mongolian territory for many years to study the Stone Age remains. From last 60 years of research, they found around 1,000 sites and published a lot of reports on the Stone Age remains.

The site types of the Stone Age period

The sites of the Stone Age period are divided into three types, namely, the plain settlement, the civilized layer remains and the civilized layer of cave remains.

Plain settlement

Almost all the remains found in Mongolian territory are included in this group. The reason for the earth stratum remaining as such was due to the severe climate of the mainland, with strong winds and storms all over the country all the time and the very low amount of the annual precipitation. Those factors made the shift of the earth stratum below average. Therefore almost every remain from the Stone Age period lies on the plains. The peculiar side of the Mongolian Stone age research is that the plain settlement strata encompass various kinds of remains that represent various ages. To date the plain settlement remains, researchers utilized methods based on the times, preservation conditions and similarities in comparison with remains which were found in other places.

Civilized layer site

Remains from a Stone Age period are called civilized layer remains when covered by soil over a certain margin. In the Mongolian territory, civilized layer remains are very rare. However, recent researches points out that there are some probabilities of the discovery of a new site.

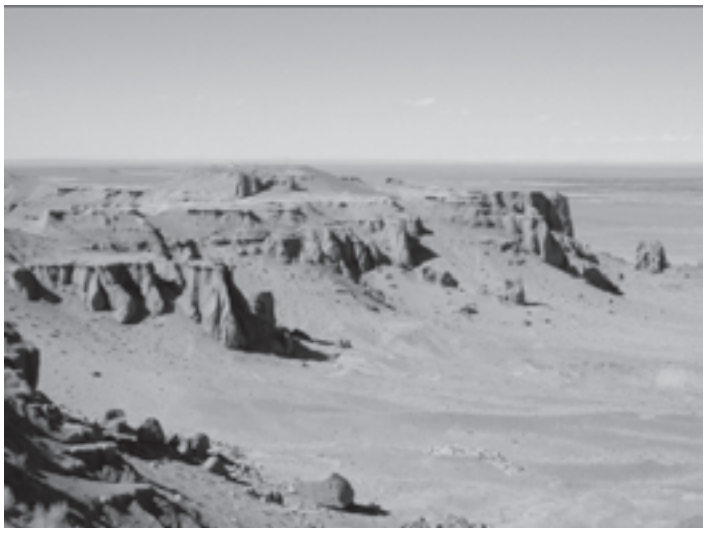
Cave site

Prehistoric people used their caves as their dwellings for many years. The cave site where people lived for a long time has also indications of short stays as well. In the Mongolian territory, *Tsagaan*

agui (White Cave) and *Chihen agui* (Ear cave) were investigated as a cave site as prehistoric people lived there for a long time.

Preservation and protection

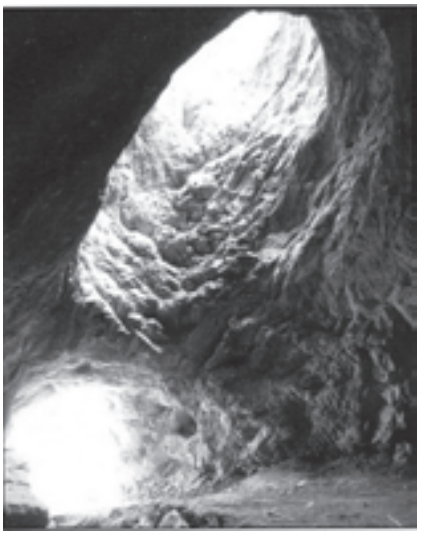
The Stone Age period sites in the Mongolian territory are getting destroyed because of the impact of people and the environment. Because of the climate chang, the desert is growing in the area and a lot of plain settlement with the Stone Age remains are buried under sand (the southern remains of the Stone Age period in the Mongolian Territory).



The site of the New Stone Age in *Bayanza*

Also recently some people are gathering remains from the soil (ground) and they are selling them to foreign tourists as souvenirs in *Bayanza*, *Bulgan sum* and *Omnogovi aimag*, for example. Currently on the site there are almost ten tourist companies, with people and entities working there, and they are planning to expand their activities.

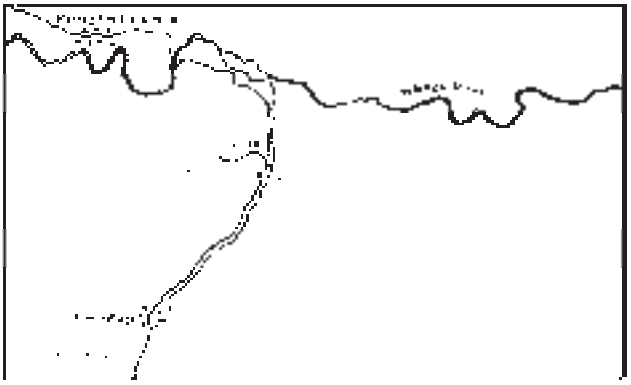
Also, people are destroying the sites by launching big projects such as mining and construction of new roads near *Tsagaan agui* (White cave) in *Bayanlig sum* and *Bayanhongor aimag*. When people discovered this site buries gold, they start digging to get gold. Now, a Chinese company tries to mine the area for gold and has bought a license for it. If we don't protect it, they will destroy the earth's soil with important remains.



Tsagaan agui (White cave)

Other site that is threatened by a same kind of situation is the *Tulbur* riverside in *Hutag-Undur sum*, *Bulgan aimag*, which is multi-layered civilized site. This place was discovered by the Mongolian-Russian joint researcher team going through the *Bulgan*, and *Huvsgul aimags* and it was named as the expedition of "Mongolian Stone Age Period" in 2002, which has excavated the site since 2004 to be researched. From the site of the *Tulbur* riverside, they found nineteen settlements and three of them were multi-layered remains of the Stone Ages that can represent the development in the period. During excavation research, they found a necklace made from an ostrich egg, bone beads etc. These remains are special artefacts showing traditional knowledge and culture of prehistoric people.

But the soil of this place was used in the road construction of Tulbur-15, the roadway between Ulaanbaatar and Murun. The site of Tulbur riverside was threatened to be destroyed by the road construction work. The place of the Stone Age remains did not easily catch the people's eye and to preserve and to protect it we had the following special ways:



Site called as *Tulbur* riverside

Tulbur-15 the current place whose soil was used to construct the road

- To place a sign containing information on the applicable penal regulations and also the sentences in case they are not followed. Moreover, the sign should contain the reason why it is protected.
- To insert the Aimag in the list of officially protected places of the nation, in the region where it is located and to appoint an official to be responsible for the place
- To preserve and to protect the lines on the walls, by making a museum for domestic and international tourists under the protection of the government
- To introduce the history, culture and acculturation, which establish the idea of loving and caring for the country among teenagers. Also, make good use of books and mass media to introduce the laws and regulations for protection and preservation toward Mongolian people.
- To increase the coherence and liability between the organizations that look after the historical and the social heritage information, protection, preservation and researches in all levels

The mining industry is rapidly developing, so an archeological research should be made on the territory to obtain a professional opinion if a mining company gets a license to mine the territory. We have to establish the regulations and legislation to protect and preserve the findings in the mining territory in Mongolian by laws on mining, land and buried properties.

We need to develop legal systems that cut off the route of illegal smuggling; make us easier to obtain information from the people; and inspire local people to protect their historical assets and cultural heritages.

IV. Lecturer Papers

Introduction to Environmental Archaeology

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This text was prepared for the "Introduction to Environmental Archaeology" given in the "Asia-Pacific Region Cultural Heritage Preservation Training Course 2010 (Group Training): Study and Preservation of Archaeological Sites" conducted by the Asia-Pacific Cultural Centre for UNESCO (ACCU). In order to systematically understand environmental archaeology and put it into practice, the people who work at excavation sites have put together a list of points requiring special attention in the process of excavating sites, organizing archaeological materials, preparing excavation reports and storing analytical samples. This text shows what is to be done at excavating site and organizing archaeological materials when conducting environmental archaeological operations. We hope this text will be of assistance when you practice environmental archaeology in your country.

1. What is environmental archaeology?
2. Archaeological sites and features in which organic materials still exist
3. Things to remember concerning excavation sites
4. Things to remember concerning organization and documentation

1. What is environmental archaeology?

Environmental archaeology is a field of archaeology that studies the mutual effect of man and environment by reproducing the paleoenvironment around the site. The objective of environmental archaeology is not to merely learn about changes in the paleoenvironment, but to find out how people of the past adapted to the surrounding natural environment, how they obtained various resources from the natural environment and how they altered the natural environment.

Environmental archaeology can be roughly divided into geoarchaeology and bioarchaeology. "Environment" in geoarchaeology refers to the geographical environment. It borrows the concepts and research methods of topography, geology, pedology, geography and so on. "Environment" in bioarchaeology refers to the natural environment. It borrows the concepts and research methods of botany, zoology, anthropology and so on.

The type of research employed in environmental archaeology is generically referred to as "natural scientific analysis." As the fields of research used in environmental archaeology become more diversified, archaeologists must conduct joint research together with experts in various types of natural scientific analysis. It also demands that the respective results research be generalized. It is important for those involved in archaeological excavation to have a clear sense of purpose, and they need to have the necessary knowledge and must be prepared in order to employ environmental archaeology properly. Vague introduction of environmental archaeology without a clear objective must be avoided.

Because natural scientific analysis may however require special apparatus, preparations or chemicals, analysis is often outsourced to other institutions. In such cases, the person or persons responsible for study conducted at the excavation site and organization of archaeological materials and those responsible for analysis must share a clear sense of purpose. A system of cooperation that ensures verifiable records is kept while maintaining objectivity is required. The persons who outsource analysis must not merely leave all results, including interpretation of results, up to those responsible for analysis, but must rather assess and summarize the results of analysis while referring to the results of study conducted at the excavation site and organization of archaeological materials. Consequentially, one must have a certain degree of understanding of the principles of and techniques used for natural scientific analysis, even if one does not directly conduct analysis himself.

Because the method of extracting information from features and/or artifacts is a natural scientific technique, interpreting results obtained by it, i.e., reconstructing human activities that took place at or around the point in time in question by means of studies conducted at the excavation site, for natural scientific analysis is no different than that of archaeology. The results of natural scientific analysis contribute to the results of other archaeological research and the overall understanding of the dig.

Just as is the case with archaeology, natural scientific analysis has methodological premises and limits. The results obtained from natural scientific analysis, therefore, are recognized as speculative theory (hypothesis) about the past. It requires combining results of analysis with other archaeological results and coming up with highly probable interpretation of the results taking into account characteristics of analysis sample and problems of analysis method, rather than blindly taking an absolute view of analytical results.

2. Sites and features in which organic materials may still exist

Artifacts unearthed from archaeological sites can be divided into inorganic materials and organic materials. Inorganic materials include stone tools, pottery and metal artifacts. Organic materials include plant remains, animal remains and human skeletal remains. Inorganic materials are generally better preserved in the earth than organic materials.

Preservation of organic materials is significantly affected by climatic conditions and sedimentary soil. Japan has a humid temperate climate, and the majority of the Japanese archipelago is covered acidic soil of volcanic ash. Most organic materials decompose and decay in such an environment. Organic materials however surely remain in some sites and features.

It is necessary to check the possibility of organic materials remaining in any and all sites. It is important to always be aware of the possibility that organic materials may remain, and to excavate a site using the proper methods while taking the sedimentary environment into account.

Shell midden / shell stratum: Acidic soil is neutralized by calcium contained in shells to produce weak alkaline soil which acts to preserve human bones and animal remains. If the site is not so-called shell midden, a small shell stratum such as a shell stratum in a pit or shell stratum within a dwelling site may be unearthed, and proper sampling must be conducted.

Cave / rock shelter: Limestone caves have an alkaline sedimentary environment produced by decomposed calcium from limestone, which tends to preserve human bones and animal remains well.

Wetland site: Wetland sites don't have enough oxygen due to the presence of underground water in a saturated state. This suppresses activity of microorganisms so organic materials are well preserved. Animal remains also tend to be well preserved if the underground water is weak alkaline or neutral.

Dune sites: Decomposition of microorganisms is suppressed in an extremely dry sedimentary environment due to lack of moisture, and may sometimes preserve organic materials.

Open site: Organic materials may remain in ordinary open sites, as well as in special sedimentary environments such as shell middens and caves. These include (1) water-infiltrated sedimentary environment, (2) burnt soil, carbide layer and ash layer.

Because decomposition is suppressed by insufficient oxygen, plant remains and animal remains tend to be preserved in a (1) water-infiltrated sedimentary environment, just as in wetland sites. Features such as rivers, ponds, wells, gutters and water places may become channels for underground water after burial and may become a water-infiltrated sedimentary environment. However, because sedimentary materials of rivers are generally formed by interaction of erosion and sedimentation, artifacts of different ages may become mixed together making it hard to judge the age of the sedimentary layer.

In the case of (2) burnt soil, carbide layer and ash layer, organic materials are burned tend to remain because they become mineralized. If proper sampling and flotation are conducted for features such as dwelling remains, fireplace remains, stoves and rubbish pits, carbonized plant remains and burnt bones may be detected. This broadens the applicable range of analysis more than the previously mentioned sites and features and is valid for all sorts of sites and features.

3. Things to remember concerning excavation sites

In recent years, natural scientific analysis employed for archaeology has become increasingly diverse, and in many cases those responsible for excavation rely on outside institutions for individual natural scientific analyses. In this case, it is important for the person responsible for the study to record the sedimentation state and excavated state of the site. It is preferable for those responsible for excavation to cooperate with those responsible for analysis from the stage where excavation is carried out at the site if possible, rather than when the excavation is complete.

Those responsible for the excavation at the site should also be responsible for natural scientific analysis rather than relying on experts. The reason for this is because analytical data such as layer position and excavated state will be lost if not properly recorded at the excavation site.

The objectives of natural scientific analysis employed for archaeology are also wide-ranging. Here we will describe the things that generally require special attention at the excavation site when conducting natural scientific analysis.

Analysis plan: When conducting natural scientific analysis, it is important to establish a plan as early

on as possible, rather than waiting until the excavation is complete. If a sedimentation layer, features or archaeological materials that are valid for environmental archaeology are confirmed by an adjacent site or trial excavation, it is necessary to properly take into account natural scientific analysis study, analysis and report into account from the planning stage of the study. When features for which natural scientific analysis is applicable are confirmed during the excavation, the study process needs to be reviewed, and the proper measures taken without delay for data sampling and analysis outsourcing.

State of site preservation: Archaeological materials that are applicable for natural scientific analysis are significantly affected by sedimentation state and state of preservation of the site. Consequently, it is necessary to consider what method or methods of analysis can be conducted, taking into account the sedimentation state and state of preservation of the site.

Clarification of objectives of analysis: When conducting natural scientific analysis, it is necessary for those responsible for excavation and those responsible for analysis to share a clear sense of purpose. If the person or persons responsible for excavation request natural scientific analysis without any clear objective, the overall view of the site could be lost and analysis could wind up impossible to assess or summarize for the excavation report of the site. It is necessary to consider specimen sampling and analysis method according to clear analysis objective and problem awareness while taking state of preservation of the site into account.

Importance of multifaceted analysis: Natural scientific analysis includes various characteristics of analysis. Thus, it is preferable to conduct a multifaceted comparison of research results combining more than one method of analysis, rather than a single method according to objective.

When conducting paleovegetational reconstruction of a site, for example, multiple analyses such as pollen analysis, plant opal or seeds should be combined, rather than conducting a certain natural scientific analysis alone. The reason for this is that cross-checking various results of analysis enables you to obtain complementary, consistent research results that cannot be obtained by a single natural scientific analysis .

Plant remains such as pollen, nuts and seeds and wood differ in terms of ability to remain, distribution and productivity of part or organ. Pollen tends to remain more than nuts and seeds and wood, so you can get a continuous understanding of vegetation for each stratification. Analysis of pollen, however, mostly involves anemophilous flower plants that produce massive quantities of pollen that is scattered over a wide area, so the composition of the pollen may not accurately represent the plant population of the immediate area. Entomophilous flower plants, on the other hand, produce less than 1/10,000 of the pollen that anemophilous flower plants produce, so the pollen does not scatter over a wide area. Materials such as nuts and seeds and wood do not tend to remain as much as pollen, and because they have more mass, then tend not to be removed from their source, and tend to represent vegetation of a smaller range of distance.

So, it is necessary to comprehensively conduct paleovegetational reconstruction of a site taking characteristics of each sample into account because they are significantly affected by the process

(taphonomy) from the stage where the material existed as a plant until it became deposited at the site

Understanding of sampling stratification: The most important thing when collecting samples for natural scientific analysis is stratification. Because organic materials are not applicable to typology that helps in the formations of chronology, there may be a problem with contamination. An accurate understanding of stratification is a prerequisite to conducting a comparative study of archaeological research results and research results of natural scientific analysis.

The excavated state of the organic materials for analysis also provides information for interpreting the results of natural scientific analysis. The samples for analysis applicable to environmental archaeology are treated the same as pottery, stone tools, etc. Before they are retrieved the stratification and excavated state are recorded. If the person or persons responsible for analysis cannot collect samples at the site, the person or persons responsible for excavation must record the stratification and excavated state of the collecting samples take responsibility for conveying the information to the analyzer. When collecting samples, care must always be taken to not allow contamination to occur.

Sampling: Sampling method and amount of soil required differ according to the research objective(s) and method of analysis. The soil required for sampling may also differ according to research objective(s) and sedimentary environment. Consequently, those responsible for collecting samples must discuss requirements and conditions for analysis samples before having them analyzed. Sampling may also sometimes be required while the excavation study is being conducted.

Even if they cannot be confirmed by the naked eye, buried pit structures, floors, fireplace remains, soil burnt by stoves, ash layer or packing soil in pottery may contain minute burnt bone fragments or carbonized plant remains. When those responsible for excavation recognize the possibility of minute remains being contained, they should take a small quantity of soil samples during the excavation study, put through a 1 - 2 mm sieve while dissolving with water and check the remaining material for minute remains. If minute remains are observed, you should sample a certain quantity of soil and sort by an organized wet sieving.

It is indispensable for those responsible for the excavation to take soil samples that are suitable for the objective(s) of analysis with the clear vision of "what kind of analysis to conduct to reveal what about the site." Soil samples must be taken in an organized manner taking into account subsequent processing and time, budget and place required for storage. If sorting soil samples by wet sieving, the issues of securing a source of water and treating wastewater/soil produced by the process must be taken into account.

Contamination: "Contamination" refers to "other things being mixed in." This term is widely used in many fields such as biology and geology. Even if samples that could possibly be contaminated are analyzed, the results of analysis would be unreliable. It is therefore necessary to make sure samples for analysis do not get contaminated when collecting them.

If collecting samples of pollen or diatoms for analysis, for example, in order to prevent present day pollen or diatoms from getting mixed in with the samples, you must be careful that no other soil is

allowed to contaminate the tools used for soil sampling. You must also scrape against the surface of walls to expose a fresh surface for taking samples. When analyzing DNA of human bones, in order to prevent contamination with the human DNA of people involved in the excavation, be sure not to touch samples with your bare hands. Be careful not to allow saliva or perspiration to come in contact with the samples.

Measures must be taken not only to prevent contamination during excavation, but during storage and/or organization prior to analysis. The problem of contamination not only involves those responsible for analysis, but those responsible for excavation and organization of archaeological materials, samples, etc. There are various possible contributing factors to contamination in the process of site formation processes, burial process, excavation, organization and laboratory work, and it is extremely difficult to completely eliminate the danger of contamination. It is therefore effective to take as many samples as possible or have some of the samples been used for the age determination such as radiocarbon dating,

It is especially important to record this in the excavation report so a third party may be able to refer to the history of the samples later on. You should also get a good understanding of the stratification, sedimentary environment and excavated state in which the sampling was conducted during excavation and properly record the locations from where the samples were taken and the sampling method used. The method by which soil samples are treated should also be properly recorded. If the person responsible for excavation does not directly conduct the natural scientific analysis, he should share an awareness of the problem of contamination with the person or persons responsible for analysis. The results of natural scientific analysis should be cross-checked with the findings at the site finding obtained from other artifacts; the results should also be interpreted and discussed.

Temporary storage prior to analysis: Even if samples are collected properly, if not handled properly during the stage before they are passed on to the person or persons responsible for analysis (temporary storage), the results of analysis could be affected. Temporary storage of and method of transportation of samples for analysis differ according to the type of natural scientific analysis. It is also necessary to take factors such as sedimentary environment into account, so those responsible for analysis should be consulted about what sort of storage is required. As a rule, transformation of properties and decomposition must be suppressed and contamination must be prevented while in storage.

The impact of chemicals used for conservation must also be taken into consideration, depending on the sample. The person or persons responsible for preserving samples should therefore be consulted in advance. For example, it has been pointed out that if resin or organic solvents in a binder, etc., get on or in a sample, it could affect carbon 14 dating. If conducting further analysis (dating, stable isotope analysis, DNA analysis, etc.) after analyzing human skeletal or animal remains, it is necessary to establish a plan quickly to provide the proper treatment.

Wooden materials such as wooden artifacts or wooden architectural members require measures to suppress decay while preventing drying are required. One method is to store in a tank of water or container to which an antifungal agent has been added. The condition of artifacts must be observed periodically with special attention on the danger of drying due to evaporation of moisture. Wooden

remains left immersed in water will become contraction-distorted due to drying, and will not revert to the former shape even if returned to the water. Once dried, the wood texture is lost, rendering wood identification impossible. Soil sampled for pollen analysis or to collect insects must be placed in a hermetically sealed container and placed in a cool, dark place to prevent the soil from oxidation or drying and to discourage fungus and microorganism from growing. Nuts and seeds should also be placed in a hermetically sealed container and placed in a cool, dark place. Animal remains and human skeletal remains should also be naturally dried in a dark place. Because it may affect analyses such as stable isotope analysis or radiocarbon dating, use of absorbent cotton should be avoided during temporary storage or transportation.

Temporary storage is no more than an emergency means up to analysis or conservation treatment. Artifacts should not be left neglected in temporary storage. They should be recorded and analyzed without delay and managed/stored properly.

4. Things to remember concerning organization and documentation

There are points to be remembered not only at the excavation site, but during organization such as washing sampled soil (soil sorting). Contamination of samples must be prevented prior to analysis. Storage of samples after analysis is also important for assuring and re-verifying results.

(1) Soil sieving methods

Objective: If archaeological materials that have been observed by the naked eye only during excavation are collected, it is highly likely that many smallest items could be overlooked. These smallest items include chips, beads, animal remains such as fish bones, carbides, and plant remains such as nuts and seeds. Collecting such smallest items requires not only materials dug up by hand at the site, but soil sediment collected by sieving. It is therefore important to collect smallest items by sieving the soil during excavation. Along with a clear objective, soil sieving must be conducted efficiently in an organized manner while taking into account labor required for subsequent sorting and place for storage.

Sieving: The size of the sieve mesh differs according to the objective of analysis. Even in the case of soil sieving methods for the same objective, the volume of dirt to be sifted may differ according to sedimentary environment, state of preservation of materials or inclusion density. When outsourcing analysis of materials that have been sifted with a sieve, it is therefore necessary to consult with those responsible for analysis beforehand concerning method of sorting the sampled soil. Concerning what size mesh the sieve should have, try sifting with several sieves of different mesh size such as 5 mm, 2 mm, 1 mm or 0.5 mm to find out beforehand what each size yields and how much work is involved. If the sieve mesh is fine, minute remains can be detected at a high percentage, but the amount of material that cannot pass through increases, and requires more time for sorting afterwards. To ensure assessment of analysis results and comparison with other sites, sieves of clear mesh size are used for sorting soil. The size of the mesh of sieves actually used for sifting soil must be clearly indicated in the documentation.

Types of soil sieving methods: Soil sieving methods are divided into dry sieving, wet sieving and flotation method according to sedimentary environment and objective. Minute remains can be detected depending on the type of sieving. It is therefore effective to combine the soil sieving methods. The block division method and wash flotation method are used in combination for detection of insect remains.

(a) Dry sieving: Effective for shell midden and cave remains, or sandy soil remains. The sampled soil is placed in the sieve, the fine sand grains are sifted through and archaeological materials are collected from residue remaining in the sieve. The effective mesh size is generally about 10 mm or 5 mm.

(b) Wet sieving: Effective for sites viscous soil such as wetland sites or silt. The sampled soil is placed in the sieve, water is poured on the soil, and fine sand grains are strained through. Minute remains such as plant or animal relicts are very fragile, so soil should be unraveled with a brush. Viscous soil should be immersed in water as a pretreatment to wet sieving. You can use a sieve with finer mesh than that of dry sieving to separate artifacts from soil using water. Mesh sizes of 10 mm, 5 mm, 2 mm, 1 mm or 0.5 mm are often used for wet sieving.

(c) Flotation: Method whereby soil is dissolved with water and stirred so archaeological materials with low specific gravity such as seeds or carbides float to the top of the water where they can be collected. Smallest items float to the top when dry sandy soil is dissolved with water alone, but viscous soil is stirred to make artifacts with low specific gravity float up. This method required a sieve with fine mesh such as 0.5 mm or 0.25 mm. Actual soil sieving often combines wet sieving; artifacts that float to the top are recovered by flotation and those that remain in the sieve with wet sieving are recovered.

Drying: Contamination must be prevented if artifacts from a wet sieve are placed in a container and dried. Collected seeds and so on shrink when dried, which can result in cracking. Such artifacts are very fragile and should be stored in a hermetically sealed container in their wet condition until identified. Floating carbides that remain in the sieve using the flotation method can be protected from damage by drying by wrapping in a cloth instead of rapid drying. Cloths used for drying should be made of finely woven cotton or blended textile. Minute remains can get caught in the course texture of gauze, thereby destroying them or making them hard to recover. Gauze should therefore be avoided.

Weighing: In order to calculate the inclusion rate of various materials, the weight and volume of soil should be measured before sieving. Weigh each type of sorted artifact and calculate the inclusion rate of the contents of each succession of strata.

Sorting: In many cases, extraction and classification of smallest items from soil samples are not carried out directly by experts such those responsible for analysis. For actual analysis, non-expert

staff may bring only materials recognized as bone fragments or seeds to the person or persons responsible for analysis. In other words, even if smallest items are collected by sifting through a sieve, materials not recognized as bone fragments or seeds may not be analyzed. In order to prevent such problems, non-experts can effectively extract and classify artifacts from soil samples on a sieve if those responsible for analysis conduct a preliminary extraction and classification. When extracting and sorting smallest items from residue of a sieve, experts should provide an easy-to-understand description of the color, size and morphological features of artifacts that need to be extracted to prevent them from being overlooked at the sorting stage.

Registration: Materials used for natural scientific analysis also contain smallest items and are therefore seldom annotated. Materials to be analyzed must be stored together with the excavation record label; care must be taken to make sure that records are not scattered and/or lost. It is also effective to annotate representative materials for analysis used for exhibitions, etc.

(2) Contents of archaeological excavation reports

The results of natural scientific analysis contribute to the results of other archaeological research and the overall understanding of the dig. The results of natural scientific analysis should therefore not be treated differently from other results such as being placed in an appendix at the end of archaeological excavation reports or as a natural scientific analysis edition, but rather should be provided before the general overview. Natural scientific analysis includes a wide assortment of methods that differ according to objective, and the reports contents therefore differ. Here we shall focus on the parts that are common to all natural scientific analysis reports.

The important thing when reporting natural scientific analysis is to state the information in such as way that a third party may verify or assess it. Also, in the case where analysis is outsourced, it is important to record necessary items such as "objective" and stratification and excavated state of "materials", soil sieving at excavating site and organizing archaeological materials in "method", and "discussion" not just for those responsible for analysis, but for those responsible for study and organization of archaeological materials as well. If conservation treatment is provided, the method of treatment should also be recorded.

Objective: Record the objective of natural scientific analysis when conducting excavation.

Materials: Provide a record of samples used for analysis. When doing so, also record the excavated state, stratification and preservation state of the samples for analysis. If chemicals are used for removal or conservation, you should record the names of the chemicals used. Record the location where samples for analysis are stored to ensure analysis results and verification by a third party.

Method: To ensure results of analysis as well, it is necessary to verify whether or not the method of analysis was proper. For this reason, clearly record the methods of sampling and analysis. If sampled soil is to be sieved, record the capacity of the sampled soil, the soil sieving method and size of the sieve mesh.

Results: Present fundamental data of analysis results so it can be verified by a third party. With radiocarbon dating, for example, in preparation of a new offset method or revision, clearly record not only the carbon 14 year, but the data used for offset or calibration. For analysis conducted to identify plant or animal remains, report photographs and descriptions that indicate basis of identification along with the identification list.

Use figures to facilitate understanding if the results of analysis include complicated data or massive quantities of data. The results of pollen analysis should be represented by pollen diagrams consisting of histograms, frequency of pollen/spore appearance, and pollen zone. If quantifying and presenting massive quantities of data, clearly indicate the method of quantification. There are several methods of calculation for reports of animal remains, such as minimum number of individuals (MNI) or number of identified materials (NISP), which can be selected according to condition of materials.

In the case of providing measurement values for analysis samples, provide graphic indication of the measurement points and method of measurement. If estimating stature from reports of human skeletal remains, clearly indicate the regression equation used for the estimate.

Discussion: Discuss the results of analysis based on the data provided and give the findings of the discussion. In some cases a clear, concise abstract such as given in the general overview may be provided. It would also be significant to discuss future themes in preparation for future excavations or organization of archaeological materials and to recommend proper methods of excavation and organization for implementing natural scientific analysis.

(3) Generalization of analysis results

The results of natural scientific analysis should therefore not be treated differently from other results such as being placed in an appendix at the end of the text of archaeological excavation reports or as a natural scientific analysis edition, but rather should contribute to the general understanding of the site.

To summarize the results of analysis, it is important to have a clear objective of analysis and an awareness of problems. The analysis method should be selected according to the objective while taking sedimentary environment and state of preservation into account. When doing so, using multiple analysis methods together while getting a clear understanding of the characteristics of each respective sample and analysis method enables you to obtain an interpretation with a higher probability of being correct.

Natural scientific analysis conducted for environmental archaeology often requires expert knowledge and special equipment, so it is sometimes outsourced to another institution. In such cases, the persons responsible for study conducted at the excavation site and those responsible for analysis must share a clear sense of purpose. A system of cooperation that ensures verifiable records is kept while maintaining objectivity is required. Results including interpretation of results must not merely be left up to those responsible for analysis, but must rather be assessed while referring to the results of study conducted at the excavation site and organization of archaeological materials. Even if you don't conduct analysis yourself, you must have a certain understanding the principles and techniques involved so you can discuss them with those responsible for analysis in order to have a general understanding of the site.

*If outsourcing natural scientific analysis to another institution, be sure that there is no lack of information that needs to be shared among those responsible for excavation, organization and analysis.

*Those responsible for excavation and organization should be aware that they bear responsibility as archaeologists and as the ones who outsourced the analysis.

*Provide the person or persons responsible for analysis with archaeological results obtained by excavation and organization and other results of natural scientific analysis in easy-to-understand terms. Also ask questions about the results of natural scientific analysis obtained until you understand.

*When doing so, keep in mind that meanings of terminology may vary slightly if there are differences in research background or fields of expertise.

*The results of respective natural scientific analyses should be compared before the deadline for turning in manuscripts in order to narrow the possibility of other interpretations of analysis. It is also effective to include a symposium-style debate.

(4) Storage of samples following analysis

Samples used for natural scientific analysis not only ensure research results but also make it possible for the results to be confirmed (re-verified) by a third party. If analysis is outsourced to another institution, storage and use of samples must be considered as well as the analysis results data.

Form of samples and method of storage differ for each type of analysis. Nuts and seed samples are placed in a small bottle and preserved in 70% ethanol solution to prevent drying and/or fungus. Leaves are placed in pouch film together with polyethylene glycol (PEG) and sealed with sealer. Pollen specimens should be provided together with the target sediment sample itself, the aggregate specimens that were analyzed, simple specimens of representative and typical pollen from the spot and strata, and prepared specimens that have been identified and counted as a set. For wood identification, prepared specimens are stored and administrated as voucher specimens. Because they ensure research results, samples for analysis must be clearly labeled with a specimen number, properly stored and disclosed.

Checklist for environmental archaeology (Nasu 2003)

1. Is the study sufficiently based on an objective? What is to be excavated and for what purpose?
2. How should theme be set when starting excavation?
   How should theme be deepened/expanded as excavation proceeds?
3. Has an effort been made to enhance the basic strength required for study and research?
4. When outsourcing analysis, etc., to another field (particularly the field of natural scientific analysis):
   (1) What do you want to know?
   (2) Is field correctly selected?
   What sort of analysis or study will be outsourced to which field?
   (3) Has the institution to which analysis is to be outsourced been correctly selected?
   Who should analysis be outsourced to in order to obtain reliable results that match the objective?
   (4) Have the objective and intention been sufficiently conveyed to the institution to which analysis is to be outsourced?
5. To what extent have problems at the site been pursued prior to outsourcing analysis?
6. Have the contents of reports of analysis results obtained by outsourced study been thoroughly understood and digested?
   (The party requesting analysis is the archaeologist responsible for the excavation.)
7. Are efforts constantly made to generalize?

Байгаль орчны эртний судлалын товч тойм

Нара мужийн соёлын өв судлалын хүрээлэн
Газрын хэвлийн өв соёлын төв
Байгаль орчны эртний судлалын судалгааны тэнхим

Ямазаки Такэши

1. Улсын соёлын өв сангийн байгууллагын харьяа Нара мужийн соёлын өв сан судлалын хүрээлэн Байгаль орчны эртний судлалын судалгааны тэнхимийн үйл ажиллагаа

1. Байгаль орчны эртний судлал ба амьтны эртний судлалын судалгаа

Балгас туурьт үлдэж хоцорсон амьтан ургамлын үлдэгдлээс тухайн үеийн ахуй орчныг дахин сэргээн үзэж, мөн тэр орчиндоо хэрхэн зохицож байсан, цаг хугацааны туршид хэрхэн хувирч ирсэн бэ гэдэг талаар судална.

2. Улс болон орон нутгийн олон нийтийн байгууллагын хүсэлтээр малталт судалгаа хийх, эмхэлж цэгцлэх ажил болон тайлан бичих ажилд хамтрах эсвэл зөвлөгөө өгөх

Туурийн шороон дотроос гарч ирэх амьтан ургамалын үлдэгдлээс эртний амьтан судлал, амьтан судлал зэрэг байгалийн шинжлэх ухаантай холбоотой салбарыг хамруулан, хүмүүнлэгийн ухааны салбар болох орчин цагийн газрын хэвлийн соёлын өвийн байгууллагад судлаачид туйлын дутагдалтай байна. Иймд улсын хэмжээнд зохих газруудын малталт судалгааг объект болгон авч, мэргэжлийн хэмжээний мэдлэг олгох, мөн холбогдох шинжилгээг явуулах судлаачийг танилцуулж өгнө.

3. Амьтны эртний судлалын үндсэн материал болох орчин үеийн амьтны араг яс, дээжийг цуглуулах болон нийтэд үзүүлэх

Амьтны эртний судлалын нэгдмэл дүрэм гэдэг бол балгас туурийн малталтаар гарсан шороон доторхи амьтны биеийн үлдэгдэл (хясаа, амьтны яс, шүд, эвэр зэрэг)-ийг дээр үеийн ямар амьтны төрөл зүйлийн ямар хэсэгт таарах вэ гэдгийг тогтоох явдал юм. Энэ нэгдмэл дүрэм бол амьтны эртний судлалын хамгийн үндсэн суурь ажил бөгөөд одоо байгаа амьтны дээжтэй хэлбэрийн онцлогийг харьцуулах явдал юм. Энэ нэгдмэл дүрмийн нарийвчлалыг улам сайжруулахад одоо байгаа амьтны иж бүрэн араг яс, үзмэр дээж хэрэгтэй юм.

4. Газрын хэвлийн соёлын өв хариуцсан ажилтны чадварыг сайжруулах зорилгоор байгаль орчны эртний судлалын дадлага (газрын хэвлийн өв соёл хариуцсан ажилтны дадлага)

Малталт судалгааг хийх хүн нь байгаль орчны эртний судлалыг системтэйгээр ойлгож, биеэ даан хийж чадах явдлыг зорилгоо болгож, малталт судалгаа хийх тухайн газар болон эмхэлж цэгцлэх ажил, мөн тайлан бичих ажлын тухайд байгаль орчны эртний судлалын ажлыг бие даан хийхэд шаардагдах мэргэжлийн мэдлэг чадвар арга технологийг эзэмшиж авахыг зорих дадлага ажлыг явуулж байна.

2. Байгаль орчны эртний судлал гэж юу болох талаар

Байгаль орчны эртний судлал гэдэг нь балгас туурь түүний эргэн тойрон дох тухайн үеийн орчныг сэргээн үзэж, хүн болон байгалийн харилцааны түүхийг судалдаг эртний судлалын нэг салбар юм. Гагцхүү эртний байгаль орчны өөрчлөлт хувьсалыг тодруулаад зогсохгүй, эртний хүмүүс эргэн тойрныхоо байгаль орчинтой хэрхэн зохицож, хүрээлэн байгаа орчноосоо төрөл бүрийн байгалийн баялагийг олзворлож байсан эсэх, хүрээлэн байгаа орчиндоо өөрчлөлт хийсэн эсэх зэргийг тодруулах зорилготой болно.

Байгаль орчны эртний судлалд хэрэглэдэг судалал бол ерөнхийдөө байгалийн шинжлэх ухааны анализ гэж ерөнхийлэн нэрлэж болно. Тус судлалын судалгааны салбар нь улам төрөлжин хөгжиж, судлаачид маань байгалийн шинжлэх ухааны олон төрлийн анализ хийдэг мэргэжилтнүүдтэй хамтарч судалгаа хийх шаардлага гардаг. Цаашлаад тэдгээр судалгааны үр дүнг нэгтгэх ажил ч гарч ирдэг. Малталт хийх хүний хувьд маш чухал зүйл бол тодорхой зорилготой ухамсартай байж, байгаль орчны эртний судлалыг зохистой явуулах бэлтгэл болон мэдлэгтэй байх явдал юм. Тодорхой зорилгогүй, зүгээр л хааш яашханаар байгаль орчны эртний судлалыг явуулахаас зайлсхийх хэрэгтэй.

Гэвч байгалийн шинжлэх ухааны анализын ажилд тусгай техник тоног төхөөрөмж болон хөгжмийн зэмсгийн зүйл хэрэг болох тохиолдол гардаг тул гаднын байгууллагаар анализ хийлгэх нь олонтоо байдаг. Тэгсэн тохиолдолд малталт судалгаа болон эмхэлж цэгцлэх ажлыг хариуцагч болон анализ хийх ажлыг хариуцагч нар тодорхой нэг зорилго ухамсартай байж, бодит чанарыг алдагдуулалгүй шалган магадлах боломж бүхий тэмдэглэл хийж үлдээхийн тулд хамтран ажиллах тогтолцоо чухал байдаг. Гэвч анализ хийлгэгч тал, анализ хариуцагч талд тайлбарыг хамруулан задлан шинжилгээний бүх үр дүнг бүрэн даатгах биш, малталт судалгаа болон эмхэлж цэгцлэх ажлын ололтод тулгуурласны үндсэн дээр, шинжилгээнээс гарсан үр дүнг дүгнэх, мөн ерөнхийлөн дүгнэх хэрэгцээ гардаг. Улмаар өөрөө тус анализыг гардаж хийгээгүй тохиолдолд ч, түүний зүй тогтол арга технологийг их бага хэмжээгээр мэдсэн байх шаардлагатай.

Байгалийн шинжлэх ухааны задлан шинжилгээ нь хот балгасын туурь, эд өлгийн зүйл зэргээс янз бүрийн мэдээлэл цуглуулдаг арга бөгөөд байгаль шинжлэлийн ухааны арга технологи гэх төдийгүй, олж цуглуулсан мэдээлэлдээ тайлбар хийх, өөрөөр хэлбэл малталт судалгаагаар дамжуулан тухайн үеийн хүмүүсийн үйл ажиллагааг сэргээж үзэх явдал нь өөрөө “ эртний судлал”тай адил юм. Байгалийн шинжлэх ухааны анализын үр дүн бол бусад эртний судлалын судалгааны үр дүнтэй хамт балгас туурийн талаарх нэгдсэн ойлголтод хувь нэмрээ оруулдаг зүйл юм. Байгалийн шинжлэх ухааны анализид ч эртний судлалын нэгэн адил аргын хувьд урьдчилсан нөхцөл байдал, хязгаар гэдэг зүйл байна. Иймд байгалийн шинжлэх ухааны анализаас олж авсан үр дүн бол ямарч гэсэн өнгөрсөн үеэс таамаглах “таамаг дүгнэлт” гэдгийг ойлгох нь зүйтэй. Зөвхөн анализын үр дүнг л мухар сохроор туйлын зөв гэж дүгнэх биш, анализ хийх материалын онцлог болон анализ хийх арга технологийн асуудлыг харгалзан үзэж, эртний судлалаас гаргасан бусад үр дүнтэй нэгтгэн үзэж магадлал өндөртэй тайлбарыг хайх хандлага гарч ирдэг.

3. Органик чанартай эд өлгийн зүйл үлдсэн байх боломжтой балгас туурь болон байгууламж

Органик чанартай эд өлгийн зүйлийг хадгалалтад цаг агаарын нөхцөл болон хөрсний давхарга ихээхэн нөлөөл үзүүлдэг. Гэвч ямархуу балгас байсан ч органик шинжтэй эд өлгийн зүйл байх боломжтой гэдгийг мартаж болохгүй. Гол нь органик шинжтэй эд өлгийн зүйл байх боломжийг байнга санаж, хөрсний давхаргын орчныг бодолцон, малталт судалгаа явуулж байгаа тухайн газарт тохирсон судалгааны аргыг хэрэглэх явдал юм.

Эртний ювуугийн үе давхарга болон агуй зэрэг онцлогтой хөрсний давхаргын орчинд төдийгүй, ердийн атар газарт үлдсэн балгасанд ч амьтны биеийн үлдэгдэл байх нь бий. Энэ нь 1. нойтон хөрсний үе давхаргын орчин болон 2. шатсан шороон үе давхарга, нүүрсжсэн үе давхарга, үнсэн үе давхарга зэрэг юм.

1. Нойтон хөрсний үе давхаргын орчинг амьд биет амьтны биеийн задрал нь хязгаарлаж байдаг учраас нам доор чийглэг газар дах балгас туурийн нэгэн адил ургамал амьтны бие тэр чигээрээ үлдэж хоцрох нь нэлээд бий. Гол мөрөн, цөөрөм, худаг, суваг шуудуу, зэрэг усны байгууламж булагдсаны хойно ч хөрсөн доорх усны урсах зам болж, усархаг хөрсний давхаргын орчин үүсэх бий. Гэхдээ ерөнхийдөө голын хөрсний давхарга нь ус бороонд элэгдэж, хөрсний давхаргын харилцан үйлчлэлээс болж үүсдэг учраас өөр өөр он цагийн эд өлгийн зүйл нь амархан холиолдох, мөн хөрсний давхаргын цаг үеийг тогтооход хүндрэл учрах нь олонтоо байдаг.

2. Шатсан шороон үе давхарга, нүүрсжсэн үе давхарга, үнсэн үе давхаргад бол органик чанартай эд өлгийн зүйл нь шатаж, үхэждэг учир амархан үлдэж хоцордог байна. Ялангуяа, орон байрны туурь, тулга, зуух, хэрэглэглэхээ больсон ухсан нүх зэрэг байгууламжаас хэрэгцээтэй дээжийг цуглуулж, хөвүүлж ялгах арга хэрэглэвэл, нүүрсжсэн ургамлын үлдэгдэл ба шатсан яс зэргийг түүн авах боломжтой. Энэ нь дээр дурьдсан туурь болон байгууламжийг бодвол задлан шинжилгээний судлагдахуун болсон том хэмжээний, төрөл бүрийн туурь балгас байгууламжид илүү үр дүнтэй.

4. Малталт судалгааг явуулж байгаа талбар дээр анхаарах зүйл

Ойрын жилүүдэд эртний судлалд байгалийн шинжлэх ухааны анализын арга нь улам бүр төрөлжин хөгжиж, малталт хариуцагч тал хувиараа байгалийн шинжлэх ухааны анализ хийлгэхээр гадны байгууллагаас хүсэх нь олширсон. Тийм тохиолдолд малталт судалгаа явуулж байгаа талбар дээр хөрсний давхаргын нөхцөл байдал болон малталтаар гарах шорооны байдлыг судалгаа хариуцагч тал нь маш сайн баримтжуулах нь чухал. Мөн малталт судалгаа дууссаны дараа биш, өөрөөр хэлбэл боломжийнхоо хэрээр малталт судалгаа явуулж байгаа судалгааны талбайгаасаа эхлэн малталт хариуцагч болон анализ хариуцагч нар хамтарч ажлаа явуулах нь зүйтэй.

Байгалийн шинжлэх ухааны анализын шинжилгээг мэргэжилтнээр хийлгэх тохиолдолд ч тухайн балгас туурийн малталт судалгааг хариуцагчийн хариуцах ёстой хэсэг гэж байдаг. Тэр бол анализ хийх туршилтын материалын хөрсний үе давхарга болон малталтаар гарах шорооны

нөхцөл байдал зэргийг малталт явуулж байгаа талбай дээр маш сайн баримтжуулахгүй бол “мэдээлэл алдагдал” болдог. Эртний судлалд хэрэглэж байгаа байгалийн шинжлэх ухааны анализын арга нь олон салаалж, тэдгээрийн зорилго нь ч өөр өөр байдаг. Энд байгалийн шинжлэх ухааны анализын аргыг хэрэглэх тухайд бол малталт хийж байгаа талбар дээр анхаарвал зохих ерөнхий зүйлийг дурдъя.

Үлдэгдэл балгасын хадгалалтын нөхцөл байдал: Байгалийн шинжлэн ухааны анализын судлагдахуун болох материалд балгас туурийн хөрсний давхаргын нөхцөл байдал болон хадгалалтын нөхцөл нь ихээхэн нөлөөлдөг. Үүний улмаас тэр балгас туурийн хөрсний давхаргын нөхцөл байдал болон хадгалалтын нөхцөл байдлыг харгалзан үзэж, ямаршуу анализын аргыг хэрэглэвэл зохистой вэ гэдгийг нягталж үзэх хэрэгтэй.

Анализ хийх зорилго тодорхой байх: Байгалийн шинжлэх ухааны анализыг хийхэд малталт хариуцагч болон анализ хариуцагч нар нь анализыг хийх ажлын талаар тодорхой нэгдмэл зорилго ухамсартай байх нь чухал. Малталт хариуцагч нь тодорхой зорилгогүйгээр байгалийн шинжлэх ухааны анализын ажлын хүсэлт гаргачих юм бол, тухайн балгас туурийг бүхэлд нь хамарсан бодлого алдагдаж, балгас туурийн судалгааны тайлан болох үнэлэлт болон ерөнхий дүгнэлтийг ч гаргаж чадахааргүй анализын үр дүнгээр төгсч магадгүй. Балгас туурийн хадгалалтын нөхцөл байдлыг харгалзан үзэж, анализын тодорхой зорилго болон асуудал болгож байгаа үзлээс шалтгаалан түүнд тохирох анализын арга болон туршилтын материал сонголт зэргийг нягталж үзэх хэрэгтэй.

Олон төрлийн анализын чухал болох нь: Байгалийн шинжлэх ухааны анализын арга нь тэдгээр анализын онцлогийг агуулсан байдаг. Иймд зорилгодоо нийцсэн анализын аргыг дангаар нь хэрэглэх биш, анализын олон аргыг хамтруулан хэрэглэж, тэдгээр судалгааны ололт амжилт үр дүнг олон талаас нь харьцуулан нягталж байх нь зүйтэй.

Жишээлбэл: балгас тууриас олдсон ургамлуудыг сэргээхдээ байгалийн шинжлэх ухааны ямар нэг анализын аргыг дангаар нь хэрэглэх биш, цэцгийн тоосны анализ, (plant opal) иж бүрэн текник-уурагт чулуу, үр жимсний төрөл зэргийг олон төрлийн анализыг хослуулан хэрэглэх шаардлагатай. Учир нь анализүүдийн үр дүнг давхар баталснаар, дан ганц байгалийн шинжлэх ухааны анализын аргаар олж авч чадаагүй зүйл буюу харилцан нөхсөн, зөрчилгүй судалгааны үр дүнг гаргах боломжтой.

Сонгож авах газрын үе давхаргыг зөв ойлгож мэдэх: Байгалийн шинжлэх ухааны анализыг хийхийн тулд туршилтын материалын сонголтын үед хамгийн чухал зүйл бол туршилтын материалыгсонгож авах газрын үе давхаргын асуудал юм. Байгаль орчны эртний судлалын судлагдахуун болох материал нь тухайн цаг үеийг тогтоох баталгаатай “загвар”гүй материал байдаг тул, будлиантай асуудал үүсгэдэг. Эртний судлалын судалгааны үр дүнг байгалийн шинжлэх ухааны олон янзын судалгааны үр дүнтэй харьцуулан нягтлахын тулд шаардлагатай хөрсний үе давхаргын зөв оношлогоо нь урьдал нөхцөл болно. Анализ хийх туршилтын материалын малталтаар гарсан шорооны нөхцөл байдал нь байгалийн шинжлэх ухааны анализын үр дүнг тайлбарлахад үндсэн мэдээлэл нь болж өгдөг.

Дээж цуглуулах тухай: Судалгааны зорилго болон анализ хийх аргаас шалтгаалан дээж цуглуулах арга болон хэрэглэх хэмжээ нь ялгаатай. Бас судалгааны зорилго болон хөрсний

давхаргын орчноос болж дээж цуглуулахад хэрэглэх шорооны хэмжээ нь өөр өөр байх нь байна. Малталт хариуцагч нь “Тийм балгас туурийн тухайд юуг тодруулахын тулд ямархуу анализыг хийх вэ” гэсэн тодорхой чиглэлийг барьж, анализын зорилгод тохирсон хөрсний шинжилгээний дээжийг цуглуулах нь маш чухал. Хөрсний дээжийг цуглуулах ажлыг хийхдээ, хожим зохицуулах ажил болон хадгалалттай холбогдсон цаг хугацаа, төсөв, байршлыг харгалзан үзэж, төлөвлөгөөтэйгээр явуулах нь чухал. Мөн хөрсний дээжийг угааж ялгах тохиолдолд хэрэглэх усны баталгаа болон бохир ус, газар шорооны ажлыг зохицуулах асуудлыг сайн бодолцох ёстой.

5. Эмхэлж цэгцлэх ажил болон малталт судалгааны тайлан бичихэд анхаарах зүйл

1. Хөрс шороог ялгах арга

Зорилго: Малталт судалгааны явцад өөрийн нүдээр ажигласан зөвхөн эд өлгийн зүйлийг л цуглуулаад, маш олон бичил зүйлийн үлдэгдлийг анзааралгүй өнгөрөх бололцоо их байдаг. Эдгээр бичил зүйлүүдэд модны хэлтэрхий, эрдэнийн чулууны төрөл, загасны яс зэрэг амьтны биеийн ясны үлдэгдэл, нүүрсжсэн зүйл болон үр жимсний төрөл зэрэг ургамалын үлдэгдэл зэргийг хамруулж байна.

Ингээд бичил зүйлийг цуглуулахын тулд судалгааны талбар дээр гараараа ухаж цуглуулсан материал төдийгүй, хөрсний давхаргад байгаа зүйлийг шигшүүрээр шигшиж цуглуулсан материал ч бас хэрэгтэй. Үүний тулд малталт судалгаанд хөрс шороог шигшүүрээр шигшиж бичил зүйлийгцуглуулах нь маш чухал. Хөрс шороог ялгах ажил нь тодорхой зорилготой байхын зэрэгцээ, цаашдын сортлох ажилтай холбоотой хөдөлмөрлөх хүч болон хадгалалтын байр зэргийг харгалзан үзэж төлөвлөгөөтэй, үр дүнтэйгээр явуулах шаардлагатай.

Шигшүүр: Хэрэглэх шигшүүрийн нүд нь анализын зорилгоос болж өөр өөр байна. Бас ижил зорилгоор хөрс шорооноос ялгах арга хэрэглэх үед ч хөрсний давхаргын орчин, материал хадгалалтын нөхцөл байдал болон агуулахын багтаамжаас шалтгаалан шигшин ялгах шорооны хэмжээг тааруулна. Улмаар шигшүүрт шигшсэн материалын анализыг хийлгэх тохиолдолд, дээж болгож авсан хөрс шороог ялгах аргын тухайд анализ хариуцагчтай урьдчилан ярилцаж тохиролцох хэрэгтэй. Мөн ямар хэмжээний нүдтэй шигшүүр хэрэглэх талаар бол сорилтын маягаар 5mm, 2mm, 1mm, 0,5mm зэрэг хэд хэдэн шигшүүрээр шигшсэнээр, шигшүүрийн нүдний хэмжээнээс болж шигшигдэлтээс үлдэх зүйл болон ажлын хэмжээ зэргийг урьдчилан мэдэж байвал зохистой. Нарийн шигшүүр байх тусмаа бичил эд зүйлийг харьцангуй ихээр олж чадах боловч, шигшүүр дээр үлдэх юм олшрох тул цаашдын ялгах ажилд нэлээн цаг хүч зарцуулах болно. Хөрс шороог ялгахад хэрэглэх шигшүүр гэдэг бол, анализаас гарсан үр дүнгийн үнэлэлт болон бусад балгас туурийнхтай харьцуулсан харьцуулалыг баталгаажуулахын тулд шигшүүрийн нүдний хэмжээ нь маш тодорхой шигшүүрийг хэрэглэнэ. Хөрс шорооноос ялгах ажилд жинхэнэ хэрэглэсэн шигшүүрийн нүдний хэмжээг тайланд тусгах хэрэгтэй.

Хөрс шорооноос ялгах аргын төрөл зүйл: Шигшүүрээр хөрс шорооноос ялгах аргыг дотор нь хөрсний давхаргын орчин болон зорилгоос шалтгаалж, хатааж шигшиж ялгах арга, угааж шигших арга, ялгаруулах түүж авах арга (эд өлгийн зүйлийг хөвүүлж ялгах арга) гэх мэтээр хуваж болно. Хөрс шорооноос ялгаснаар олон төрлийн бичил эд зүйлийг олж авч чадах

учир, эдгээр хөрс шорооноос ялгах аргыг хослуулах хэрэглэх нь үр дүнтэй. Үүнээс гадна хорхой шавьжийн үлдэгдлийг илрүүлэхэд хэсэглэн хуваах арга болон усаар угааж хөвүүлэх аргыг хослуулан хэрэглэдэг.

1. Хатааж шигшиж ялгах арга: Ювуугийн үе давхарга, агуйн үлдэгдэл болон элсэрхэг хөрсөн дөх балгас туурийн судалгаанд илүү үр дүнтэй. Цуглуулж авсан дээж хөрс шороог шигшүүр дээр асган, нарийн ширхэгт зүйлийг доош унагааж, шигшүүр дээр үлдсэн шаар дотроос эд өлгийн зүйлийг түүж цуглуулж авна. Ерөнхийдөө хатааж шигшихэд тохиромжтой шигшүүрийн нүхний хэмжээ нь 10mm, 5mm орчим байна.

2. Усаар угааж шигшин ялгах арга: Нам доор чийглэг газар дах балгас туурь болон тунасан шавар зэрэг наалданг чанартай хөрсөн дөх балгас туурийн судалгаанд энэ арга нь илүү тохиромжтой. Цуглуулж авсан хөрс шорооны дээжийг шигшүүр дээр асган дээрээс нь ус асгаж жижиг ширхэгтэй зүйлийг тунгаан шүүнэ. Амьтан ургамлын үлдэгдэл зэргийн бичил эд зүйлийн үлдэгдэл нь эвдэрч хэмхрэхдээ амархан тул сойзоор наалдсан шороог арилгана. Наалданг чанар ихтэй хөрс шорооны хувьд урьдчилсан арга хэмжээ болгож усаар угааж ялгалт хийхийн өмнө усанд дэвтээж орхих нь зүйтэй. Усаар эд өлгийн зүйлийг шорооноос нь салгаж цэвэрлэхдээ, хатааж шигшихийг бодвол нарийн шигшүүр хэрэглэх нь тохиромжтой. Шигшүүрийн нүдний хэмжээ нь 10mm, 5mm, 2mm, 1mm, 0,5mm -ийн шигшүүрийг хамгийн их хэрэглэдэг.

3. Хөвүүлэн ялгах арга: Шороог усанд уусган хольж, үр жимс болон нүүрсжсэн зүйл зэрэг хувийн жин хөнгөн эд өлгийн зүйлийг хөвүүлж түүж авах арга юм. Хатсан элсэрхэг хөрс шорооны хувьд бол шороог усанд уусгахад л бичил зүйлүүд нь хөвөөд гараад ирдэг бол, наалданг чанартай хөрс шорооны хувьд бол эргэлдүүлэн хутгаж урсгаснаар жингээр бага зүйлийг хөвүүлэн гаргадаг. Ингэхэд 0,5mm болон 0,25mm-ийн нарийн шигшүүр хэрэгтэй. Шорооноос ялгах бодит ажил дээр бол усаар угааж шигших аргыг хослуулж, хөвүүлэн ялгах аргаар эд өлгийн зүйлийг хөвүүлэн цуглуулж авах болон усаар угааж ялгах арга хэрэглэн шигшүүр дээр үлдсэн эд өлгийн зүйлийг түүж цуглуулах нь их байдаг.

2. Задлан шинжлэх аргаар гарсан үр дүнг нэгтгэх

Анализаар гарсан үр дүнг нэгтгэхэд юуны өмнө нарийвчлан задлан шинжлэх зорилго болон асуудлын талаарх зөв ойлгоцтой байх нь чухал. Тэгээд хөрсний давхаргын орчин болон хадгалалтын нөхцөл байдлыг харгалзан үзэж, зорилгодоо нийцсэн анализын аргыг сонгоно. Тэгэхдээ анализ хийх материалууд болон анализын аргын онцлогийн талаар ойлгоцтой байх төдийгүй, олон тооны анализын аргыг хослуулан хэрэглэвэл улам магадлал өндөртэй тайлбар гарах болно.

Мөн байгаль орчны эртний судлалд хэрэглэж байгаа байгалийн шинжлэх ухааны анализын аргыг хэрэглэхэд мэргэжлийн мэдлэг чадвар болон тоног төхөөрөмж зэрэг нь шаардагдах учраас, анализыг гаднын байгууллагаар хийлгэх нь бий. Тэр үед малталт судалгаа хариуцагч болон анализ хариуцагч нар нь тодорхой нэг зорилго ухамсартай байж, бодит чанарыг алдагдуулалгүй шалган магадлах боломж бүхий баримтжуулж үлдээхийн тулд хамтран ажиллах тогтолцоо чухал байдаг. Тэгээд анализ хариуцагч талд задлан шинжилгээний тайлбарыг хамруулан бүх үр дүнг бүрэн даалгах биш, малталт судалгаа болон эмхэлж цэгцлэх ажлын үр дүнд тулгуурлан, анализаас гарсан үр дүнд дүгнэлт өгөх хэрэгтэй. Үүний тулд анализыг гардан хийгээгүй ч

түүний зарчим болон арга технологийг их бага хэмжээгээр мэдэж байж, балгас тууриин талаар ерөнхий ойлголттой байхын тулд анализ хариуцагчтай ярилцаж хэлэлцэж байх хэрэгтэй.

Байгаль орчны эртний судлалыг хэрэгжүүлэхэд
шаардагдах шалгах хуудас (Насү 2003)

1. Малталтын зорилгоо бүрэн тодорхойлсон эсэх. Юуны тулд хаана малталт хийх вэ гэдгийг.
2. Малталт хийж эхлэх ажлын тухайд ямар нэр ус оноосон болох.
   Малталт хийх үйл явц нь малталтын ажлын нэртэй хэр зэрэг гүнзгий хамааралтай болох, мөн дэвшилт гарсан эсэх.
3. Сорилт·судалгаанд шаардагдах үндсэн мэдлэг чадвараа
   дээшлүүлэхэд мэрийж байгаа эсэх
4. Өөр салбар (ялангуяа байгалийн шинжлэх ухааны салбар)аас анализ хийлгэх хүсэлт тавих тохиолдолд,
   1. Юу мэдэхийг хүсч байгаа талаар
   2. Салбар сонголт зөв эсэх талаар
      Ямар салбараас ямархуу анализ·судалгааг хүсэх вэ гэдгийг
   3. Анализ хийлгэх газар (хувь хүн эсвэл байгууллага) сонголт зөв эсэх
      Хэнд хандвал зорилгодоо хүрсэн, бас хамгийн итгэлтэй үр дүнг гаргуулж чадах вэ гэдэг талаар
   4. Анализ хийлгэх газрынханд анализ хийлгэх зорилго зорилтоо бүрэн ойлгуулсан эсэх
5. Хүсэлт гаргахын өмнөх шатанд судалгааны жинхэнэ газар дээр асуудлыг чухам аль хүртэл судалсан талаар
6. Итгэл найдвартай судалгаагаар олдсон анализын судалгаатай холбогдсон үр дүнгийн тайлангийн агуулгыг бүрэн дүүрэн ойлгож авсан эсэх
   (Хүсэлт гаргасан эзэн нь угаасаа эртний судлаач буюу малталт хариуцагч байх)
7. Үр дүнг нэгтгэхэд байнга санаа тавьж байгаа эсэх

Basic Knowledge of Cultural Properties Photographs

Photography Dept., Nara National Research Institute for Cultural Properties

1. Introduction

Photographs are indispensable for study of cultural properties and must therefore be understood by anyone engaged in the study. If however cultural properties are photographed without understanding the objective and framework for taking photographs, the photographs will not yield an abundance of information. The fundamental principle of photography of cultural properties is to enable storage of materials that record an exhaustive amount of information in place of the cultural properties themselves for an extended period of time.

2. Role and types of photographs of cultural properties

Photographs of cultural properties include photos used for work and documentary photographs obtained by research and restoration as shown in Fig. 1. There are many types of photography including the most common type of photography used on a routine basis and so-called "optical survey" such as X-ray photography and infrared (IR) photography as shown in Fig. 2.

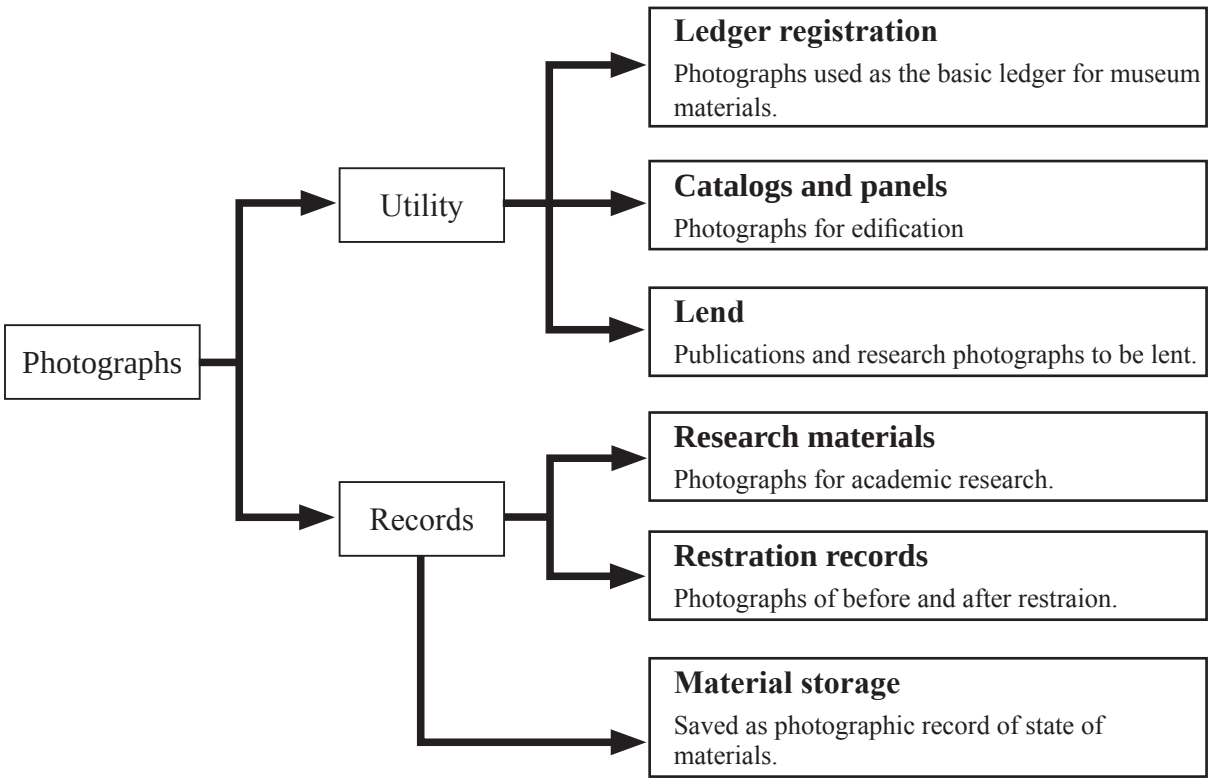

Fig. 1: Role of photographs

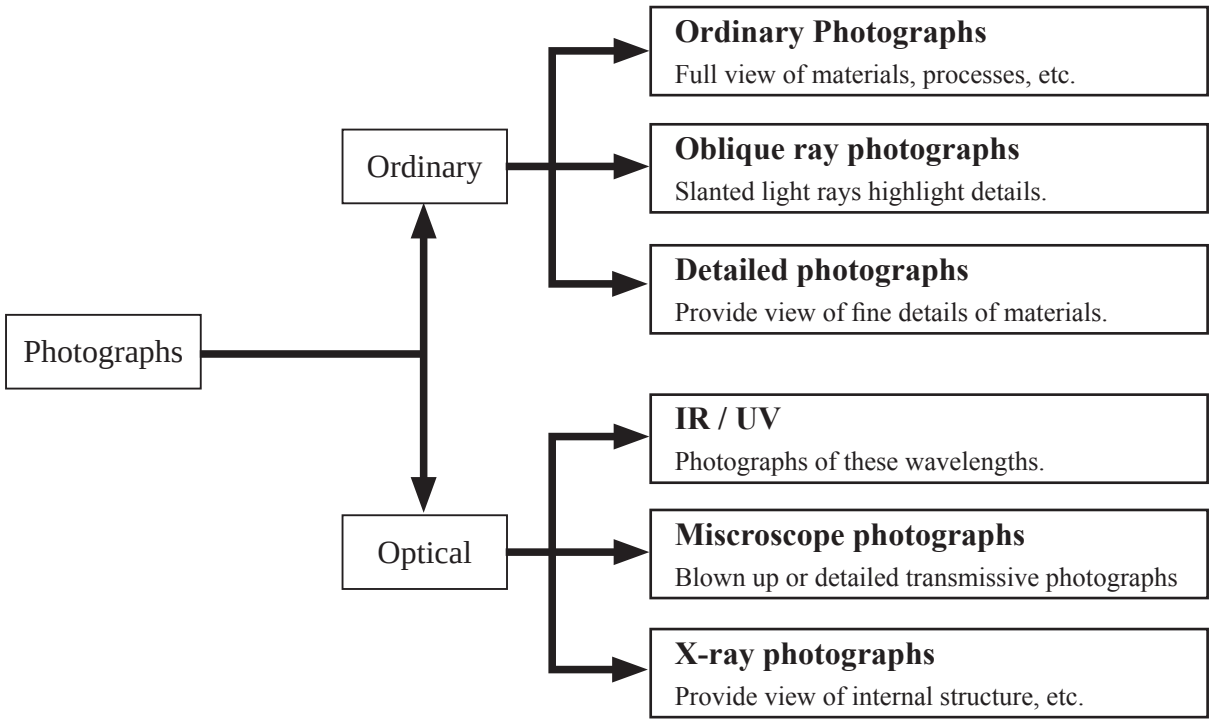

Fig. 2: Types of photographs

3. Types of cameras

There are various types of cameras, which differ according to film size. The larger the film size, the larger the camera tends to be. Larger film size also offers better picture quality. Consequently, larger cameras are used if better picture quality is desired. The size of the camera does not only affect picture quality. Single-lens reflex cameras take photographs in 24 x 36 mm rectangular format; there are also cameras that take 60 x 60 mm square photographs. The difference between rectangular and square significantly affects the photograph itself. Digital cameras also have a surface called CCD or CMOS that records images (photo-sensitive element). Just as with film size, the larger the surface, the better the picture quality generally is.

(1) 35 mm single-lens reflex camera

The most commonly used camera can flexibly adjust to various photographing conditions such as automatic focus, manual focus, macro photography, lens change, etc.

(2) Medium size cameras

Sixty millimeter roll film is referred to as "Brownie film." This type of film is used by medium sized cameras that take 60 x 45 mm or 60 x 90 mm photos. Medium size cameras are often equipped with separate film holders. Some conventional cameras can be converted to digital cameras by exchanging the film holder for a picture element such as a CCD picture element.

(3) Large cameras

Sheet film is changed for each photograph for large cameras. Film sizes include 4 x 5 inch (postcard size) and 8 x 10 inch (A4 size). Such film offers superior quality photographs. The photographer must however make all adjustments manually, including focusing and setting the diaphragm and shutter speed. The lens and film holders are connected by bellows, and therefor offer the advantage of tilt-shift photography to correct distortion that can be caused by the lens. Digital photographs can be taken by replacing the film holder with a picture element such as a CCD picture element.

4. Digital single-lens reflex camera

Digital cameras also come in many types that vary according to size, type and effective sensor resolution (hereinafter referred to as "pixels"). Here we have used a digital single-lens reflex camera equipped with a 35 mm picture element as a model. Let's take a look at its features.

***Pixel count**

If we enlarge the picture you can see a mosaic like image consisting of rows of squares. Each of these squares is called a "pixel." The number of pixels is the pixel count. For example, if the image consists of 4000 pixels vertically and 6000 pixels horizontally; it therefore consists of 4000 x 6000 pixels, or 24 million pixels. This is an index in addition to determining quality of a photographic record. It does not however mean the larger the pixel count, the better the picture quality is, but rather determines the total performance such as the lens precision and CCD recording format.

***Gradation**

Gradation expresses rich coloring for the factors that decide picture quality. Gradation refers to picture representation performance. Rich gradation enables expression with smooth color. There are shades of gray between white and black; some shades of gray are closer to white, while others are closer to black. If gradation is rich, color changes smoothly from white to black. If gradation is poor, smoothness is lost.

***Picture element**

Picture elements come in various sizes. Recently, many single-lens reflex cameras use 24 x 36 mm picture elements called "full size." 1/1.8 picture elements often used by compact cameras are only 1/16 the size of a 35 mm picture element. If the pixel count is the same for these picture elements. that is, 10 million pixels, the per pixel area of the 35 mm size would be larger. The larger per pixel area is able to receive more optical information, so gradation is richer (See Fig. 3).

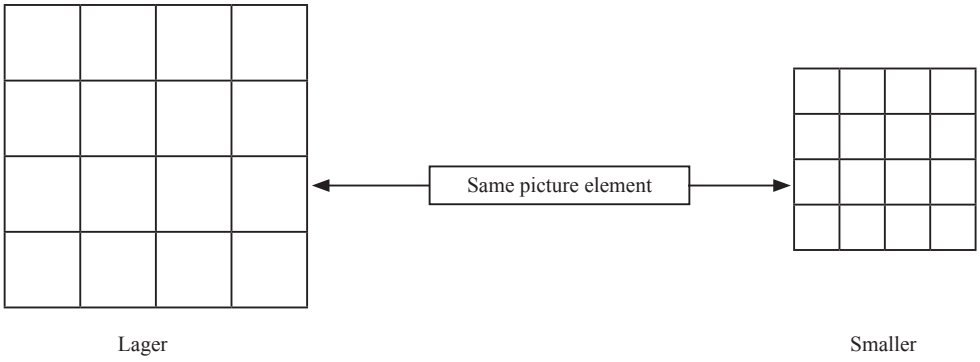

Fig. 3: Correlation of picture elements and gradation; The large area is capable of receiving more light.

***High sensitivity / noise prevention**

The larger the picture element, the larger per pixel area is and the more optical information it can contain. Improving efficiency of converting light to electronic information makes noise less likely to be produced. Also, because conversion is efficient, low intensity light can also be recorded efficiently, and better photographs can be taken because sensitivity is higher.

***Resolution**

Resolution indicates concentration of pixels per unit area for output. The number of pixels required depends on output method and size, but if the pixel count is too low, resolution will be low (see Fig. 4) and the image will not be clear. The number of pixels required for output size must be met (see Fig. 5).

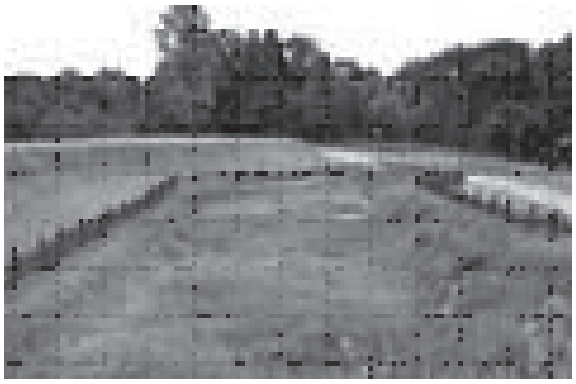

Fig. 4: Unclear output
Low resolution
(Ex. 50 dpi 2 x 3 inch output)

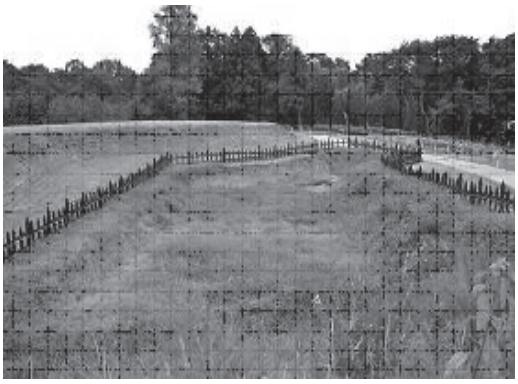

Fig. 5: Clear output
Sufficient resolution
(Ex. 96dpi 2 x 3 inch output)

5. Digital photograph image saving format

Images photographed with a digital camera are first recorded as raw image files. With digital cameras such as single-lens reflex type, you can choose to save as raw image files or JPEG format. Compact digital cameras may only be capable of saving in JPEG format. JPEG format enables you to view the photos is all sorts of digital environments. Raw image files, on the other hand, can only be handled as they are, and must be processed on a computer. Image processing refers to converting digital data to a format that can be viewed such as JPEG or TIFF (See Fig. 6).

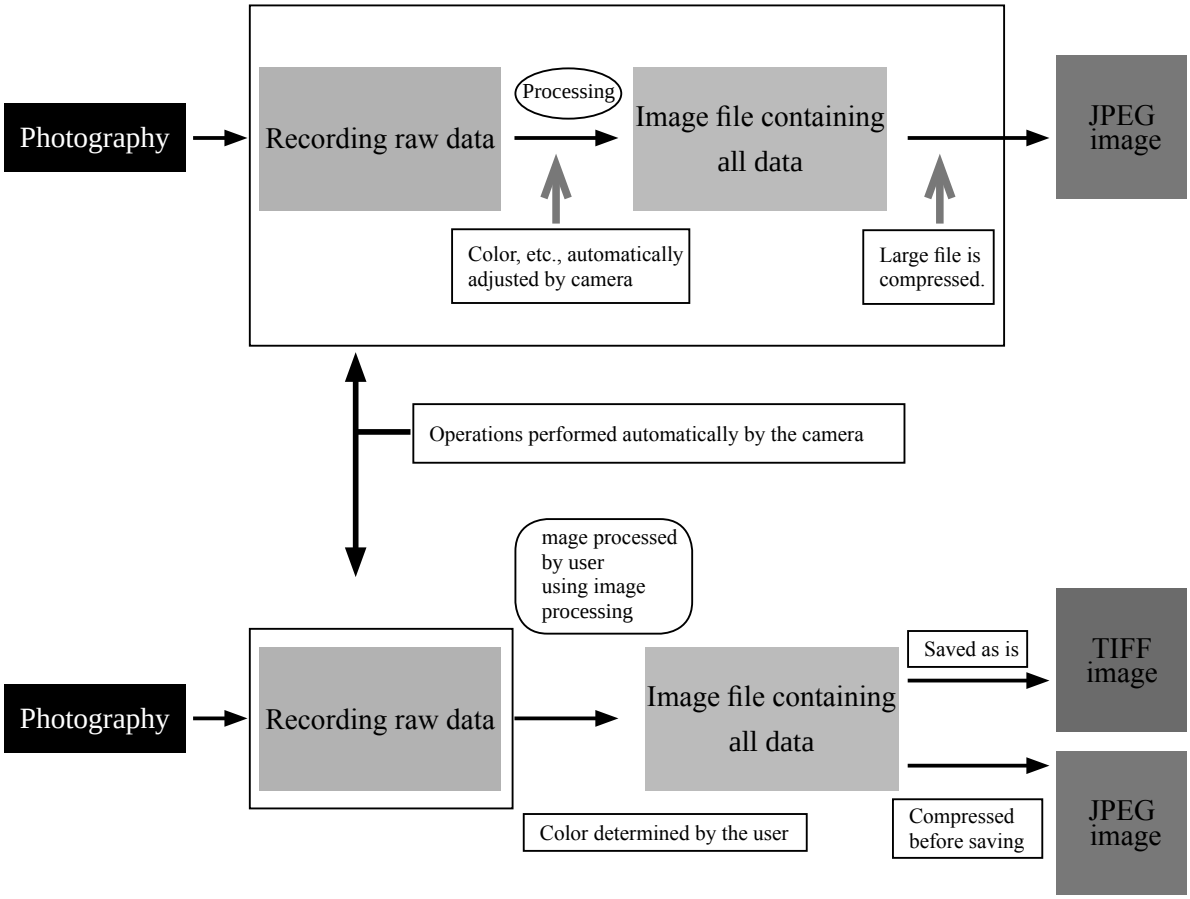

Fig. 6: JPEG format

***Raw image files**

Raw image files are the optical data obtained by photographing itself; raw image files are raw data prior to processing. Raw data (all data pertaining to the image) cannot be viewed as an image until it is processed. Raw data is the origin from which JPEG images are produced. The camera just automatically processes and compresses the raw data. As long as you have the raw data, you can avoid having the camera process it and decide the picture quality for you. Cultural properties must be saved as raw image files.

***JPEG format**

Image data obtained by a digital camera and saved in JPEG format is raw data that is automatically processed by the camera. Automatically processed image files are compressed to a degree where image quality is not affected. The degree of compression can usually be selected. If you want to preserve quality by maintaining a large file, you select a lower compression ratio, and if you prefer a smaller file with lower quality, you select a higher compression ratio. JPEG format maintains comparatively high quality even if the compression ratio is altered.

The drawback of JPEG format is that compression ratio is left up to the camera. The information of compressed files is inferior to the raw image data before being automatically processed by the digital camera; once data is lost it cannot be recovered. Because the data is automatically processed by the camera, aspects such color are determined by the processing; the images can only be processed within the parameters of the camera itself. Consequently, because photographs of cultural properties may have to be used in various sizes and subsequent processing may be required later on, processing by the camera is not really suited to such photography.

***TIFF format**

TIFF format allows photographic image data to be saved without compression, thereby maintaining the size of the file. Bitmap data, which simply consists of a mapped array of bits of optical data, is a basic format, and is therefore suited to a wide range of applications. TIFF format is a stable format with a high potential for being reproduced in the future. Uncompressed files can be quite large, but it the most suitable format for saving photographic image data of cultural properties that may have to be used in various sizes or subsequent processing may be required later on.

In the case of digital photography, no matter what format an image file may be saved or by what procedure it is saved, you must record the proper tone and light status by photographing a gray card or color target, and save the image data processed based on it, and then make use of the saved image data.

In the case of photographing using a gray card, light source by which the image was photographed and neutral tone are reproduced by computer based on gray without being affected by color bias, so it is necessary to save the digital image reproduced based on it when photographing cultural properties requiring precise recording. Details concerning the methods of photography and preproduction processing are provided in the attached document. Theses can be viewed by accessing the website at the following URL (Japanese only). http://maishaken.cool.ne.jp/cgi-bin/diarypro/data/upfile/5-1.pdf

6. Mechanism by which a photograph is taken

Up to this point, we have talked primarily about cameras. Now we will talk about the mechanism by which photographs are taken to produce the desired results.

***Photograph and exposure**

For our purposes, the object of taking a photograph is to record the subject exactly as it is. To do this, the image of the subject is reflected by adjusting the focus and shutter speed. The light that enters the camera through the lens must be properly recorded on the surface of the film or picture element. Adjusting the proper amount of light is called "exposure." As long as the light is adjusted to the proper amount, the subject will be photographed at the correct exposure. The diaphragm adjusts the size of the aperture through which the light enters. If the diaphragm is opened, more light enters, and if it is closed, only a small amount can enter. Shutter speed is the amount of time the shutter the covers the aperture through which light passes is open. If the film or picture element continues to be exposed to light longer than is needed, the photograph will eventually appear white. "Overexposure" occurs when there is too much light. Inversely, if there is not enough light, the photograph will be dark. This is referred to as "underexposure."

***Function of the diaphragm**

We learned that the amount of light can be adjusted by how much the aperture of the diaphragm is opened. Now let’s take a look at how this works. Under ordinary circumstances, the lens are marked with FX. X, FY and FZZ. These units are diaphragm numbers called "f numbers." The larger the diaphragm number, the smaller the aperture is, and the smaller the number, the large the aperture becomes.

***Function of shutter speed**

Shutter speed is the amount of time between when the camera shutter is pressed, the shutter opens, light comes in through the aperture in the diaphragm, and the shutter closes, thereby ending exposure. Cameras are equipped with a shutter speed adjustment function.

***Correlation of the diaphragm and shutter speed**

How do the diaphragm and shutter speed affect the photograph? Here is a photograph taken with the f number set to F8 and correct exposure of 1/125 of a second. If we consider the diaphragm and shutter speed, several patterns of correct exposure can be prepared. If for example we think we can get correct exposure by changing the setting of the diaphragm from F8 to F16, the diaphragm aperture becomes smaller and the amount of light that passes through the diaphragm aperture is reduced. In order to secure the amount of light necessary for correct exposure, we must therefore reduce the shutter speed. Oppositely, if we change the setting from F8 to F4, the amount of light that passes through the aperture increases, so shutter speed must be increased.

***Correct exposure and exposure compensation**

If the built-in automatic exposure function of the camera is used, the diaphragm aperture and shutter speed are automatically adjusted according to the amount of light that the camera determines to be correct exposure. Both may however exist simultaneously if the subject is too light or dark, or is photographed against a white backdrop, and the exposure may consequently not be correct for the subject. The light distribution of the entire screen is calculated according to the characteristics of the camera to determine correct exposure, and the camera is incapable of determining what the subject is. If photographing a dark subject against a bright backdrop, the camera determines the amount of light for the entire screen and darkens the exposure; correct exposure can however be obtained if the photographer takes the initiative to brighten the exposure. If photographing a bright subject against a dark backdrop such as black or gray, correct exposure can be obtained if the photographer takes the initiative to darken exposure. This is called "exposure compensation." Positive compensation is provided for a bright subject and negative compensation for a dark subject in order to archive correct exposure. The method by which exposure compensation is achieved differs according to the camera. It is important to read the camera's instruction manual carefully and get empirical knowledge of the procedures.

***Focus range = field depth and focus depth** (Fig. 7)

One function of the diaphragm is to adjust the amount of light, but it has another important role, i.e., to adjust focus range. Increasing the f number widens the focus range, and decreasing it shrinks the range. The focus range is referred to as "field depth." Field depth varies according to the type of lens as well as the diaphragm setting.

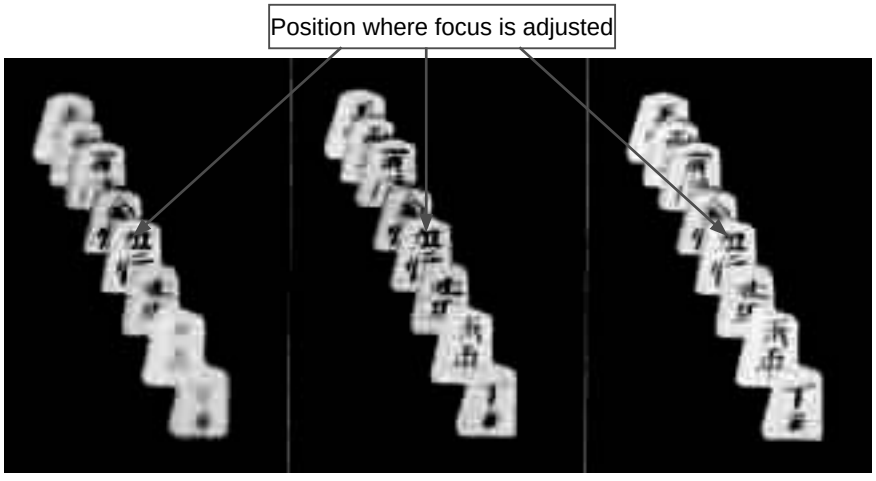

Fig. 7: Field depth and focus depth

The photograph taken with F22 appears sharper than the one taken with F2.8. This tells us that the range(field depth) of F22 is wider. The focus is behind the silver general in the photograph taken with the F2.8 setting. This tells us that focus depth is the rear surface.

***ISO sensitivity**

The mechanism by which photographs are taken contains another important factor. The factor is "sensitivity." "ISO sensitivity" is the sensitivity for the films reaction with light. In other words, the reaction differs according to the sensitivity with which the film receives the same amount of light.

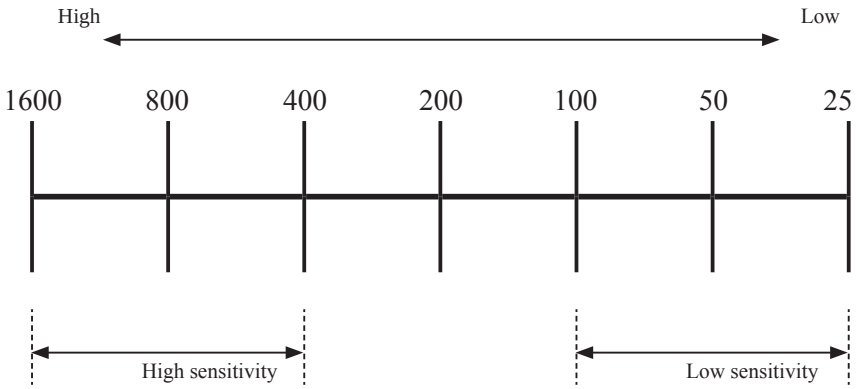

Fig. 8: ISO sensitivity

As shown in Fig. 8, The higher the number, the higher sensitivity is, and the lower the number, the lower the sensitivity is. This means that the higher sensitivity is, the less light is needed to take photographs, and the lower the sensitivity is, the more light it takes to achieve correct exposure.

There are several combinations of diaphragm and shutter speed settings that realize correct exposure. The same goes for ISO sensitivity. Changing from ISO100 to ISO200 is the same as changing the diaphragm and shutter speed settings by one increment. The higher ISO sensitivity is, however, the more gradation and sharpness deteriorate, regardless of whether film or digital medium is used. ISO sensitivity must be carefully set (see Fig. 9). Cultural properties may generally be photographed with sensitivity set between ISO100 - 200.

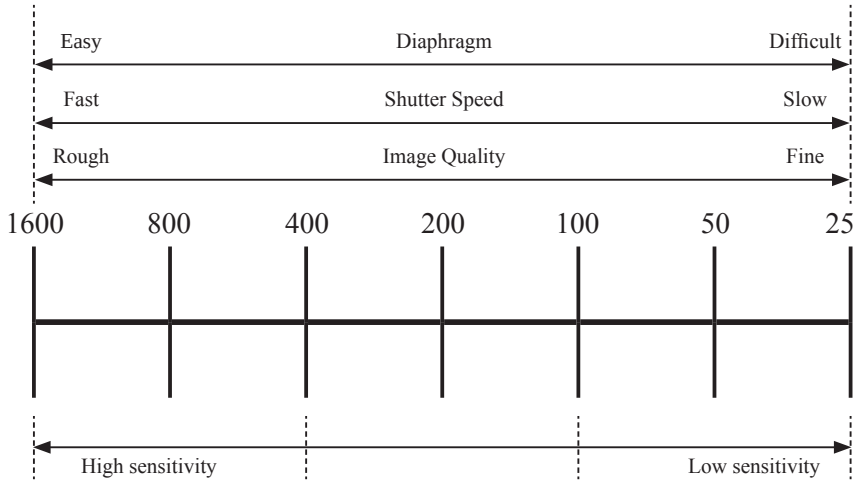

Fig. 9: Correlation of ISO sensitivity and diaphragm setting

7. Light orientation = Lighting

It would not be an exaggeration to say lighting and composition are everything to photographing point when photographing cultural properties. Light orientation -- the angle at which light strikes the subject -- is an element that has a decisive effect on the quality of the photographs. With the exception of special circumstances, the fundamentals of lighting refer to making it reflect off the walls, or flexible "indirect light" such as light dispersed through tracing paper or white cloth. With direct light, strong shading or halation are caused by the angle of the light, resulting in a photograph that does not convey enough information. Lighting includes types with various functions. The light beams that affect expression and atmosphere are called "main light,"and the light beams that adjust brightness of the subject are called "sub light." Key light, which is used to express fine parts of the subject or top light / sky light, which adjust brightness of the background are sometimes used.

Quite a significant amount of heat is produced by lighting equipment. Organic substances, in particular, may be damaged by rapid drying. It is consequently necessary to device a way to minimize irradiation time.

***Main light irradiation direction and effect**

***Forward light (light from front)**

State where the subject receives light from the front; in this state, the photograph provides a planar impression. This type of lighting produces a dark vertical shadow according to the irregularities of the subject. This type is not generally used because shading of the subject cannot be expressed.

***Oblique light (oblique light from the side)**

Forward oblique light from the side. Part where light is angled and shading is pronounced. Produces a more 3-dimensional photograph than forward light. Most basic type of light.

***Side light (light completely from the side)**

Light directly from the side of the subject. Irregularities on the surface of the subject can be clearly recognized.

***Top light (light from directly above)**

State where the subject receives light from directly above. Does not tend to produce a shadow, so there is no need to worry about the direction in which the shadow will be produced.

***Back light**

Light that strikes the subject from directly behind.

***Semi back light**

Light that strikes the subject obliquely from behind.

***Transmission light**

Light that clearly shows the contour, etc., of the subject. Used in combination with forward light and oblique light. Subjects are photographed using combinations of these types of light so the subject can be recognized well.

***Photographing pottery shards and stone tools from above**

In order to avoid the shadow of the subject from falling into the background thereby making the contour unclear, the subject is placed on a sheet of transparent glass that if raised from the background. If the background is not bright enough, brightness is adjusted by shining auxiliary light on the background. The subject and background are both basically illuminated by main light. It is necessary to come up devise measures to avoid producing halation for shiny subjects such as stone tools made of obsidian, such as using reflected light or creating indirect light using tracing paper.

***Photographing planar subjects such as ancient texts from above**

Subjects such as ancient texts are placed on a copier and photographed from above. A level is first however placed on the camera and the subject is set parallel to the camera. The entire subject is uniformly illuminated. The light source is aimed at the copier with lamps set at 45 degree angles to the left and right.

***Photographing using paper backdrop**

Color of the paper backdrop is selected according to the color of the subject. A neutral color such as gray or white is generally used to avoid color transfer to the subject. Illumination varies according to the size and 3-dimensional structure of the subject, but basically consists of a combination of top light and main light.

8. Structural outline

Photography is the act of forcing the subject to fit in a limited frame. The appearance of the photograph varies according to the way it is fit into the frame, in other words, the structural outline.

***1/3 structural outline**

This is the method of arranging the subject by separating the screen into 1/3 horizontally and vertically.

***Structural outline with subject in center:**

Structural outline with the subject positioned in the center of the screen. The information you want to convey about the object to be photographed is directly expressed. Lots of museum materials are photographed using this structural outline. Since it is used for publications and so on as well, a proper margin is left around the subject.

***Camera angle**

When considering the structural outline, it is important to think about what is to be placed where. It is also important to consider from where the subject is to be photographed, in other words, the camera angle. The impression varies according to whether the subject is photographed from a high or low angle, or from a frontal angle. The appearance of the subject also varies if the left and right angles are changed.

9. Lens

Lens are classified by millimeter units. This is referred to as "focal length." If the focal length is small, it is capable of photographing a wide angle (wide angle lens), and if it is large, it can zoom in on a limited range (telephoto lens). In addition to these, there are standard lens that can photograph from close up without restriction.

Telephoto lens

Standard lens

Wide Angle lens

10. Image processing

In the case of film, color tone and contrast are adjusted when developing. In the case of digital photographs, images are processed using image processing software such as Photoshop after photographing. These processes are classified as "adjustment" or "processing." Operation differs according to the type of image processing software used. The user must therefore read the software manual well familiarize himself with operation.

***Adjustment**

Adjustment refers to precise adjustment of color tome reproduction or contrast, trimming, etc. This task is always required when processing digital images. In an ideal situation, digital images should basically not be processed any more than necessary for saving. It is therefore important to sufficiently consider photographing conditions before taking pictures.

***Processing**

Processing basically includes getting rid off unwanted images, converting color tones or altering color of the subject; it also refers to adding effects, etc., to images. There are many problems with processing photographs of cultural properties which play an important role as a record. Photographs are not processed under ordinary circumstances.

V. Participants' Final Reports

MUNKHUU Bayarsaikhan

First of all I want to thank Mr. NISHIMURA Yasushi, Director of Cultural Heritage Protection Cooperation Office, Asia-Pacific Cultural Center for UNESCO (ACCU). By his invitation I have participated 31 days training programme from 16 November to 16th December 2010 with other workers from Institute of Archaeology, Mongolian Academy of Sciences to take basic and professional training in archaeology.

Participating in the training, we have learned new knowledge and information on archeological excavation and research methods; making conservation treatment for artifacts and objects in a laboratory; documentation by taking photos; how to do research works; preservation and protection of excavated artifacts for later utilization as exhibition at a public museum.

During our stay in Japan, we visited many historical and cultural sightseeing places: Horyui-ji temple, Yakushi-ji temple, Todai-ji temple, Heijo Palace Site, Rokuon-ji temple, Kiyomizu-dera temple, Kyushu National Museum, Dazaifu, Yoshinogari site, in cities of Nara, Kyoto, and Fukuoka. When we visited Kiyomizu temple in Kyoto built on high mountain area among beautiful nature, I was much impressed and wondered how one can build such a great building. There were also many other wonderful historical and cultural artifacts.

We also visited Kyushu National Museum and Fukuoka City Archeological Centre on the field study and learned at first hand how people with various professions were cooperating to preserve and restore artifacts newly found by archeologists in the laboratory; how people were working to preserve and protect their cultural heritage. Another thing we have found very wonderful in Japan is not only historians and archeologists are preserving and protecting their cultural heritage also all citizens are concerned about it.

We want to thank Mr. KOBAYASHI Kenchi, interpreter Ms. Dagola, Ms. SHIMIZU Natsuki and other staff for being always with us and very helpful all the time throughout the training session.

I wish ACCU Nara the best of further success in their activities on cultural heritage protection.

RINCHINKHOROL Munkhtulga

It is impossible to write all the knowledge, information and impressions gathered during this training. So I would like to list the most instructive topics for us and issues which I must indicate. However I've seen many examples for each item listed below, I will not include any examples due to limited time.

- It was obvious that the policy of Japanese cultural heritage protection is a policy that concerned to the future.
- Highly specialized experts are collectively researching in all aspects of ancient cultural heritage.
- We have a chance to learn a great deal in the intensive and organized training schedule.
- Lecturers introduced us modern methods, techniques, tools, and research products, which made the training more fruitful.
- During the class session, lecturers introduced us the most appropriate methods for Mongolian situation and we practiced them.
- We had a chance to get useful information and knowledge in a short time.
- Research in Japan was made in a high quality level; technology and research methodology seemed modern and the best.
- We were also introduced to working ethics and research ethics in cultural heritage protection; and to everyday regime, practical procedure for cultural heritage protection.
- Communication skill of workers in NNRICP was great, and we were given latest information.
- Training environment was good and we were provided with enough supplies.
- We had an impression that Japanese legal systems on cultural heritage preservation, protection, research are perfect in all aspects in comparison with Mongolia.
- We were introduced to modern techniques and technology of cultural heritage preservation, protection, artifact documentation.
- It was clear that every personnel working in the field of cultural heritage protection must understand his/her responsibilities and must follow the regulations and laws.
- For raising public awareness, education, advertisement, media tools are very useful.
- I liked not only conserved artifacts, but also its comfortable environment constructions, which is open to the public as a whole complex.
- Site protection systems, especially government regulation for its protection, seemed to me very important.
- While building a museum, they avoid to damage cultural heritage site.
- The laboratories in NNRICP are well appointed.
- Several internal organizations support personnel's working condition. - We have been introduced to laboratories in the institute in order.
- It was clear that every personnel treat their ancient artifacts with a sense of responsibility and precisely follow documentation, preservation and restoration processes.
- We learned how to create cultural heritage information system and general information system.

- Travelling to various historic sites and observing archaeological artifacts helped us to understand an outline of ancient Japanese culture.
- We visited World Heritage sites in Kyoto and Nara which we have dreamed of and got firsthand knowledge on how they were preserved and protected.
- Museum staff explained us about exhibition in detail such as development, technology etc.
- Restoration of site should be based on accurate research.
- We have been introduced to not only museum exhibits, but also newly discovered artifacts.
- We learned the important points in preserving and protecting remains and artifacts.
- Training condition in the organization was very good, so we were in comfortable environment.

In conclusion, I can say that I have learned many things from the training session in short time.

DAVAAKHUU Odsuren

ACCU Nara works in the city of Nara in Japan and invites archeologists and cultural heritage specialists to their training programmes so as to teach them to protect Asian-Pacific culture heritages and sites. I had a chance to participate in one of their programmes when they organized the programme for the Mongolian Academy of Sciences from 16 November to 16 December 2010.

In this program, the main objectives of the training was to get familiar with the Japanese archaeological remains and to acquire the Japanese way of research and restoration of remains in practice, and to be used to the tools and equipment to excavate and restore the remains and sites.

During this training programme, they introduced many sites and prehistoric remains in Nara, Kyoto and Fukuoka located in the island of Kyushu: Heijo Palace sites, Gango-ji temple, Asuka-dera temple, Museum of Archaeological Institute of Kashihara, Horyu-ji temple, Yakushi-ji temple, graves with historical contents from the 3rd to 4th century BC, remains of some kind of burned vases; Kiyomizu-dera temple, Kinkaku-ji temple, Ryoan-ji temple; Yoshinagari Historical Park, Kyushu National Museum, Daifazhu site, Mazuki site, Ono-jo citadel, Daifazhu Tenmangu shrine, remains of Keneno Kuma site, Itazuke remains, etc. One of the significant features of Japanese researchers is that they do not just excavate the site, but they pay a lot attention to restore it to its original state and to show it to the public. Therefore during our visit, we observed how the remains were restored to its original state in good condition.

We saw that the palace and temple remains were reconstructed with high technological tools as the result of the research in the areas under the government protection. I'm happy to say that the sites that we visited during the programme were inscribed on UNESCO World Heritage and they were under Japanese government protection.

Those sites and remains were shown to the public to foster the thoughts of people to protect and to love the cultural heritages. We need to borrow the Japanese way to raise awareness in teenagers mind to protect the cultural heritage, but the problem is we have a very small population in a large expansion of land, and also we have few people studying and working in research and protection for cultural heritage.

During the training programme, we learned the Japanese research methodology and the way they were compiling the documentation of the remains. This practical training was taught under the guidance of researchers of Nara National Research Institute for Cultural Properties and we got familiar with the way of drawing the survey maps of the area, drawing the surface map, conserving roof tiles by using unique keys, getting ink-rubbing of the roof tiles, measured drawing of a vase and some weapons from the Stone Age, and taking photographs of artefacts in the training.

Mongolian researchers don't have their own way to draw Stone Age weapons, and they usually use the Russian method to draw them. I have learned the Japanese method to draw weapons, so I can use it in my further researches.

For Prehistoric researches, it is very important to have the original picture of the unearthed artifacts for documentation. During this training session, we had a chance to work in the photographing section in NNRICP. I learned how to take good pictures from the sides and right above the artifacts, therefore I can use this technique for my further studies.

During this training, we also observed the process in conservation of artifacts: chemicals, methods and technical tools. Researchers on the institute were working efficiently with cutting-edge technical equipment and modern tools for excavation and conservation.

It was very interesting to see the displayed strata that researchers at NNRICP took off from the cross section with chemicals. We can use this method for our research and especially for the research of the multi-layered site. Mongolia has a lot of remains but because of weather conditions and the location of the land, there remain not a lot of multi-layered sites. Therefore, we need to duplicate the landscape of multi-layered site to show it to the public and to get their attention, so as to disseminate the information of Stone Age period to people of Mongolia. Also we need to use this method to document the sites that are threatened by road construction and mining.

I have seen many artifacts preserved and conserved at NNRICP and Nara Municipal Archaeological Research Center. These organizations have compiled very good documentation on all artifacts, which they classified and organized according to each storage method.

Finally, I figure this training gave us new ideas, new methods for our future research work, and new information to be used in our further researches. I am very thankful to ACCU Nara which gave us this special opportunity and helped us throughout the training session.

VI. Appendix

1. List of Participants
2. List of Lecturers and Interpreters
3. Staff Members, ACCU Nara

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