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Siem Reap – June 2-3, 2009 – Sokha Angkor Resort

English version



COMITE INTERNATIONAL DE COORDINATION POUR LA SAUVEGARDE ET LE DEVELOPPEMENT DU SITE HISTORIQUE D'ANGKOR  
INTERNATIONAL CO-ORDINATING COMMITTEE FOR THE SAFEGUARDING AND DEVELOPMENT OF THE HISTORIC SITE OF ANGKOR

**Technical Committee**  
**Comité Technique**

# **Eighteenth Technical Committee** **Dix-huitième Comité Technique**

co-chaired by / coprésidé par

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Siem Reap – June 2 & 3, 2009 – Sokha Angkor Resort

Siem Reap – 2 et 3 juin 2009 – Sokha Angkor Resort

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**NOTICE:** The languages used during the sessions of the ICC are English, French and Khmer. In the English language record of the discussions, all material spoken originally in French or Khmer is therefore a translation. Presentations and comments made originally in English are indicated by <sup>[OrigE]</sup> at the beginning of the contribution. The insertion <sup>[OrigK]</sup> shows that the original statement was in Khmer.

## RECORD OF THE DISCUSSIONS

### I. OPENING SESSION

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#### **I.1 Statement by the French Co-chairman, Mr. Dominique Freslon, Counsellor for Cooperation and Cultural Affairs with the Embassy of France**

“Honourable Deputy Prime Minister,  
Honourable Ambassadors,  
Honourable General Director,  
Ladies and Gentlemen,

It is a renewed opportunity and equal pleasure for me to co-chair with Mr. Norio Maruyama, Senior Minister with the Embassy of Japan, this technical session of the International Co-ordinating Committee for the safeguarding and development of the historic site of Angkor.

We will work together for the next two days and I welcome all to this 18<sup>th</sup> session.

I would particularly like to greet H. E. Mr. Sok An, Deputy Prime Minister, President of the APSARA National Authority and H. E. Mr. Oum Weachiravuth, High representative of His Majesty the King Norodom Sihamoni.

I would also like to greet H. E. Mr. Thong Kon, Minister of Tourism and H. E. Sou Phirin, governor of Siem Reap province.

Your faithful attendance Excellencies, Gentlemen, highlights the importance that the Kingdom of Cambodia gives to the proceedings of our Committee, and I would like to warmly thank you for this.

I would also like to welcome all members of the diplomatic corps working in Cambodia or attending this ICC; experts and scholars who will give the opportunity for those who are not experts, as I am, to share their passion for Angkor. Let me also mention Prof. Konrad van Baelen, Director of the Raymond Lemerre International Conservation Centre in Belgium, host of the Royal Government; you are welcome to the ICC.

But this session will miss one of its major regular attendees, Professor Suzuki, who has retired. He is a well known figure among us, as he was a member of the Expert group for Angkor. The French Co-chair would like to pay a legitimate tribute to Prof. Suzuki for the work carried out and the passion and eagerness displayed while serving Angkor. Thank you professor and enjoy your retirement!

As we are on the subject, I would also like to evoke the departure of my colleague, Norio Maruyama, seated beside me, a senior Minister for the Japanese Embassy and Co-chair of this technical session of the ICC. After three years in Cambodia, bringing his skills and professionalism, Norio has been called upon to meet new challenges and will leave us



in a few months. Today is his last ICC, and it is with sincerity and legitimacy that I enjoyed working with him, having had the pleasure of collaborating with him on the ICC, the Angkorian heritage and on other items, and I will miss him very much.

The French delegation attending this 18<sup>th</sup> session, which I have the honour and pleasure of accompanying, includes for the Ministry of Culture, Mr Bruno Favel, Head of the delegation of the mission for European and International Affairs at the directorate of architecture and heritage, and of Mrs. Véronique Deze, official representative. The *École de Chaillot* is also among us represented by Mrs. Natacha Pakker, official representative, as is the Ministry of Foreign and European Affairs, represented by Mrs Francine d'Orgeval. All these individuals are accustomed to the ICC proceedings and they look forward to bringing their skills to the proceedings.

They, like me, would like to thank the APSARA National Authority, represented by its Director General M. Bun Narith, UNESCO, represented by Mr. Azedine Beschousch, permanent scientific secretary of the ICC and Mr. Teruo Jinaï, representative of UNESCO in Cambodia. With the help of their teams and of the one of the secretariat of the ICC, this committee will proceed as smoothly as usual and will be crowned with success.

Excellencies, ladies and Gentlemen,

Some figures: this 18<sup>th</sup> session includes two days of proceedings, 124 participants, 55 speeches and presentations; the growth of the ICC highlights its attraction and success.

But as with all successes there is a down side. A diagnosis of the existing risks was carried out and internal regulations were adopted last year and handed out to the participants.

This technical session is the first to proceed within the framework of these internal regulations and the procedures of the presentations for the next two days will underline this novelty.

Let's hope that the contents will also be on the same par.

These regulations, beyond the establishment of procedures and operations aiming at organising and regulating the sessions in order to maintain their efficiency, also recall some of the "guidelines" set during the 1993 Tokyo Conference and re-used ten years later during the Paris conference: "guidelines" which serve as reminders of the spirit governing the International Committee.

These guidelines are the framework followed by the ICC when managing issues that are raised during its proceedings. Besides guidelines on conservation and research, the internal regulations recall and empower those concerning sustainable development of which sustainable tourism is a vital sector. It draws consequences following the assessment of the role played by the population for the future of the Angkorian sites.

The overarching issue regarding the future of Angkor is agreed by all and well defined: that of a development that is ensured by relevant conservation and protection of the sites and by mastering tourism while respecting the populations and the spirituality of the sites. The threats concerning the population, the temples, water, the forest and the environment have been, at least partly, identified.

The majority of the early sessions of the ICC since its onset have been dedicated to issues related to conservation and research. This was the case until 2003, when issues pertaining to sustainable development and tourism were mentioned for the first time during a public session. These issues are now set on a regular basis on the agenda of the Committee for both sessions.

But if the framework has been correctly set up, it seems that all the issues it is dealing with are not dealt with an equality of arms, up to the level of the existing stakes. But there is certain urgency in bringing operational answers to the coming challenges.

If for example we look at the agenda of this 18<sup>th</sup> Committee, 25 papers deal with conservation and 11 with sustainable development during tomorrow's proceedings.

The reasons for this inequality may be easily identified: the history of the research and of the works on Angkor which in contents and numbers are included in today's agenda.

The status of the site also played a role. Initially listed as in danger and enduring uncertain times, the site underwent initiatives to ensure its safeguarding and safety, goals set on the short and mid terms which favoured restoration and conservation.

But there is also mainly the structural issue, which is linked to the understanding of the sustainable development topic, in order to turn it into problematics then into activities in the field. There are also uncertainties in terms of defining institutions and the profiles of the men in charge of this topic, the format of which is still largely to be defined on the ground.

Although the consequences of the negative evolution of the environment of the sites, temples and populations have been known for a while, implementation in the field is still delayed.

In the past years, and with the rapid growth of the world economy triggering a massive but mainly uncontrolled tourism flow, the sites have been damaged further and faster, overriding the engine, and putting under pressure lawmakers and academics in order for them to find quick, concrete answers.

This urgency is on a daily basis and a source of time wasting.

The ICC and all its partners have taken action. Progress has been recorded but the first effects in the field will take some time to make themselves apparent; concepts have emerged and institutions have been set up, such as the expert group on sustainable development. The APSARA Authority was restructured to be better prepared to face the situation. A water day has been organised.

Nowadays things are slightly changing.

According to recent figures from the Cambodian Ministry of Tourism, the amount of foreigners visiting Cambodia has been decreasing steadily since the beginning of 2009 year

by year. Figures show a drop of 2.2 percent in January, of 6.5 percent in February and of 1.4 percent in March.

This is not alarming, and in terms of volume the calculated decrease is almost insignificant, as during the first quarter of 2009 there were only 22,000 tourists less than in the first quarter of 2008. In March 2009, the site received 203,000 visitors which represented only a drop of 3 percent compared with March 2008. This could be seen as a sign of stabilisation.

But this brings a halt to dealing with emergencies and with the management of the constant increase of tourism flow over the past few years.

This welcome rest gives us room for hindsight, facilitating a more serene reflection but also enabling us to deal in the field with topics which were previously stalled. Notably, issues regarding training and empowerment for the people, items which were already on the agenda in 2006 but were not dealt with despite their stakes. Facilities and institutions are also concerned as sustainable development is the environment, the economy and also the climate and governance; they are all intertwined.

To face the present global crisis, the Royal government of Cambodia has followed this policy by implementing the necessary measures to minimise the impact of the crisis.

On a matter close to us, the national Assembly has just ratified a Law on tourism which provisions will certainly benefit, as one can imagine, visits to the Angkorian sites. Other measures are being implemented.

In line with the harmonious and sustainable development of Angkor, there are many topics to deal with in this period of time: one of these concerns public funding at a time when States, donors and recipients struggle to mobilise resources. It is a time of questioning financing methods, their diversities, finding new methods and the role that the private sector could play.

The present, due to a global economic crisis of major proportions, is sadly synonymous with negative growth, uncertainties and the return of financial insecurity. But it is also a time for initiatives and innovations. This is a real opportunity which must not be ignored.

The ICC, a place for discussion and proposals, will with no doubt deal with these changes during the next two days.

Thank you for your attention."

## **I.2 Statement by the Japanese Co-chairman, Mr. Norio Maruyama, Minister with the Embassy of Japan**

“His Excellency Mr. Sok An, Deputy Prime Minister, Chairman of the APSARA National Authority,  
 His Excellency Mr. Yim Nola, Senior Minister with the Council of Ministers,  
 His Excellency, Mr. Thong Kon, Minister of Tourism,  
 His Excellency Mr. Sou Phirin, Governor of Siem Reap,  
 Excellencies, Ambassadors,  
 Honourable Co-chair and friend,  
 Excellencies, Ladies and Gentlemen,

I am deeply honoured to welcome among us the High representative of the King, Mr. Oum Weachiravuth, who always honours us with his presence. I would also like to welcome Professor van Baelen; I am sure as an expert you will find this session most interesting.

I had drafted an opening session speech but, as the announcement regarding my departure in the coming months has been made, it will sound rather like a closing speech.

I would like to share with you my deepest appreciation of the three years spent among you, in particular the intensive work with the technical committee, which has not only enriched my knowledge but also widened my understanding of the historic value of the Angkor site.

As Co-chair I worked hard with Dominique in order to serve you better and to hold more relevant debates during the technical committee. In 2006 it came to our attention that there was no real distinction between the plenary and the technical sessions. Mrs. Françoise Rivière also made this assessment as representative of the General Secretary of UNESCO. We then worked towards improving the distinctions between both sessions.

We are still halfway, as the past three years have not been sufficient for a complete overhaul but I think that we were and are moving in the right direction. I would now like to present an overview of our progress, especially on the internal regulations. Previously there were no written structures of technical or plenary sessions, the quadripartite, etc. It is this written document which now prevails for transparency of the decision taking process as per internal regulations. I then consider it as a useful, basic and structuring tool for the ICC.

In order to extend time for discussion during the technical session a novelty has been introduced. Looking at the agenda you will notice that the discussions previously grouped at the end of a session are now planned at the end of interventions per field. This allows for a better interaction between the speaker and the questions that could have been triggered by its paper. To me this is paramount in opening up a discussion.

Presentations are also grouped into topics. For example the teams working on stone conservation will make their presentations in succession. This will allow you to establish a comparison on a topic and facilitate a debate. Now that the tool has been improved, it is up to you to better make use of it.

Finally an additional item regarding sustainable development is being set. As mentioned by Dominique, the diversity of this field forces us to prioritise one particular topic. With the help of UNESCO and the APSARA Authority several water colloquia have been organised which were finalised with the establishment of a working group interacting

with the ICC. Following this achievement, we would like, in the near future, to propose the establishment of a thematic and technical session solely dedicated to the issue of water. The speakers will further develop this point in the next two days and this could serve as a good example of a technical discussion when the subject of sustainable development is mentioned.

Looking at the time, I do not want to be the first to step out of my imparted slot of five minutes; I end my speech and simply hope for a successful ICC session.

Thank you for your attention.”

**I.3 Statement by the Representative of the Royal Government of Cambodia,  
HE Mr. Sok An, Deputy Prime Minister, Chairman of the APSARA National  
Authority**

“Honourable Co-chairmen,  
Excellencies,  
Ladies and Gentlemen,

I would firstly like to thank, on behalf of all of us, the organisers, experts, and representatives of member countries of the International Co-ordinating Committee for the Safeguarding and Development of the Historic site of Angkor, the ICC; and also observers who have dedicated their precious time to take part in this important ICC meeting. The experts need also be congratulated for their work, carried out with foresight, intelligence and professionalism. I thank you all for participating in the national effort for the safeguarding and development of Angkor.

You all know that it is always a renewed pleasure to take part in the proceedings of our International Committee for Angkor. According to the unanimity of observers, the regular sessions, the relevance of the debates, the fair play and quality of these and of the observations have made the ICC an outstanding forum on heritage. The ICC is an example for a steady and constantly evolving monitoring, as unbiased as possible, of the management of one of the leading sites of World Cultural Heritage.

And despite our success, the common goal remains to always improve, to tackle issues and to meet in the best possible conditions, the universal management standard of the World Heritage.

That is the reason why, Excellencies, Ladies and Gentlemen, I would like forthrightly to call upon all international teams working in Angkor. Next year in July 2010, the World Heritage Committee, under the aegis of UNESCO, will be sent a report on the condition of conservation and management of the Angkor site.

The drafting of this report is mainly the duty of the APSARA National Authority’s Departments. The scientific managers and technicians will draft the report under my supervision and the coordination of the General Director of APSARA. I am convinced that the ICC standing secretariat and the *ad hoc* experts will assist them in this skilful, accurate and demanding task.

I would like to remind you that the conservation and development of Angkor is a task shared by the international community, as defined by the October 1993 Tokyo declaration and confirmed by the November 2003 Paris declaration.

It is then the mission of each international team to contribute to the overall drafting by sending to the Office of the General Director of the APSARA National Authority a detailed report summarising works carried out on the monuments they have been entrusted with. This report shall be finalised before the end of November 2009.

Excellencies, honourable Co-chairmen,

I am certain that you will join me in this appeal, as it is important for the World Heritage Committee to be informed objectively, in detail and as comprehensively as possible, of the works which for the past years have been undertaken and which constantly and positively impact on the Angkorian landscape.

This is in line with the credibility of our ICC and with assuming our duty to report. On this matter, I propose, Messrs. Co-chairmen that the ICC deals in detail with the Secretariat of the ever important issue of communication. Recently, here or abroad we have found out that information that is inaccurate or incomplete, and occasionally completely unfounded or misleading, may be spread.

It is then our duty to give out on a regular basis, transparently, information on the works in progress, on programmes and projects, on the ICC's recommendations and on the future outlook. The outcomes of this-I hope rapid-reflection might then be submitted to the next plenary session of our Committee and be subjected to a special recommendation for immediate implementation.

I would also like to suggest that, from now on, the ICC informs on a regular basis the World Heritage Committee of its activities. This could be an illustrated summarised report prepared by the secretariat. This would prevent any unfounded misjudgements or observations regarding the protection and development of Angkor and the ongoing International activities.

Excellencies, Ladies and Gentlemen,

Within this assembly the issue of water has been focused on many times; it is a core and determining issue for the region of Angkor and in particular for Siem Reap. I would like again to thank the UNESCO office in Cambodia and the ICC's standing secretariat for all their efforts in assisting the activities of the Royal Government and the APSARA National Authority, in order to strengthen an integrated approach and cooperation between all stakeholders involved in the management of water, including the private sector. The future establishment of a permanent body for the coordination and follow-up in this vital field will certainly ensure the implementation of recommendations and the execution of planned projects.

As far as I am concerned, I would like to beware of the following: avoidance of any

wastage and mismanagement of water, and maintaining supply. As mentioned previously, water shall be considered as national heritage and I called upon responsible citizenship and on the patriotism of each Cambodian.

Water symbolises our great concern: the Environment. As you are all aware, one of the paramount conditions to ensure sustainable development is to ensure quality of life. This guideline is the backdrop to the programmes set up by the province, districts and mayors, under the aegis of HE Mr. Sou Phirin, Governor of Siem Reap, in order for these programmes to be harmonised with projects carried out by the APSARA National Authority. A constant relationship will be maintained between the vast cultural and natural heritage area of Angkor and the town of Siem Reap. In town, the town hall and the Department of Urban Heritage under the supervision of the APSARA National Authority are operating major works to prevent any type of pollution in order to fight as much as possible against poverty and to gradually improve the living conditions of citizens and tourists. We are all aware that this is a huge task and that a considerable amount of financing and human resources are necessary. Let me remind you that France, with AFD financing, and Japan, through the activities of JICA, have brought their expertise to this field. It is also a great pleasure to inform our Committee that the International Association of French-speaking Mayors (*Association Internationale des Maires Francophones*, AIMF) has just decided to support sanitation projects for preservation and the development of a network of canals with the aim of enhancing the cultural and natural landscapes of Siem Reap

Evidently, these projects also concern eco-tourism, which is an added value.

On this matter, and as tourism in the region of Siem Reap/Angkor is mainly cultural, let me underline one important point. The global economic downturn is often seen as the reason for the decrease in visitors for the first half of 2009. But is this a sufficient diagnosis? Should we put up with it? I do not believe so. This is why HE Mr. Thong Kon, Minister of Tourism, shall be praised for taking the initiative to analyse the situation in Angkor/Siem Reap. This study, jointly led with the Phnom Penh UNESCO Office and the ICC secretariat, shall re-assess the methodologies and management modes and plan pioneering activities.

We must think our way out of the crisis, and regenerate on healthier, streamlined and richer grounds, the cultural tourism in the region.

Excellencies, honourable Co-chairmen, Ladies and Gentlemen,

Our ICC will, as is customary, study issues on Conservation and Development which fully commit to the future of the Siem Reap/Angkor region. This is highlighted by the agenda. Personally, I will pay attention to any constructive remarks and suggestions. I would also like the experts and officers working in the Departments of the APSARA National Authority to keep track of the debates and to note down in particular any items that could be of relevance to improve the management of the Angkorian site, a World Heritage site.

For us, good management is the vital goal. Regarding this matter, I solemnly re-assert that the Royal Government, led by the Prime Minister Samdech Akka Moha Sena Paddei Decho Hun Sen, abides by the decisions taken during the 1993 Kyoto Conference and confirmed in 2003 during the Paris conference. I also reiterate my statement that the APSARA National Authority and its restructured Departments will listen to the observations of the World Heritage Committee and see to the implementation of its recommendations.

Excellencies, Ladies and Gentlemen,

Today, you can be proud of your activities, carried out for the safeguarding and development of Angkor. I would like to express my sincere gratitude to all of you for the work achieved. Finally, I would like to wish all the best for the proceedings of this 18<sup>th</sup> technical session of the ICC.

Thank you for your attention."

**I.4 Statement by the Representative of the UNESCO Director-General,  
Ms. Françoise Rivière, Deputy Director-General for Culture, Read by  
Mr. Azedine Beschouch**

"Honourable Co-chairmen,  
His Excellency Mr. Sok An Deputy Prime Minister, Head of the Cambodian delegation,  
His Excellency, High Representative of His Majesty the King,  
Honourable Ministers,  
Excellencies,  
Ladies and Gentlemen

I would start by expressing my deep satisfaction. A look at the agenda of this 18th technical session for Angkor has confirmed that we are definitely heading in the right direction. As was agreed between the Co-chairmen of the ICC, H.E Sok An and myself, both ICC sessions are now clearly distinct in their subjects and goals. I would like to thank on that particular point the international teams for their understanding and cooperation, including their distinguished professors, experts, archaeologists or historians, architects or engineers, and all of those who see to the conservation and development of Angkor.

On behalf of the General Director of UNESCO, Mr. Koïchiro Matsuura, I would like to congratulate them and pay them a much deserved tribute. Thanks to them and to the outstanding professionals working in the different Departments of the APSARA Authority, the Angkor site remains a flagship of the World Heritage List as well as a reference for the community of the conservators of World Cultural Heritage throughout the world.

It is a pleasure to find out that the ICC remains an unequalled model which has been valiantly operating on for the past 16 years, a balanced and fruitful operation. This is certainly due to the wisdom of our successive co-chairmen and to the partnership established between the international and national participants and to the efficiency of the secretariat. It is also derived from the professionalism and spirit of solidarity manifested at the highest international level from the experts that I would also particularly like to honour.

But this is also due to the constant support of the government of Cambodia and in particular to the sustained action of HE Mr. Sok An, Deputy Prime Minister and Chairman of the APSARA National Authority. On behalf of the National Director of UNESCO, I would like to pay tribute to him as his presence among us bestows this Committee its national and international credibility.

Excellencies, ladies and Gentlemen,

It will be a pleasure to be among you for the next plenary session, already number 16. In the meantime I can only express hope for the full success of the proceedings.



## II. RESEARCH AND CONSERVATION

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### II.1 ICC Activity Report and Implementation of Previous Recommendations, by Mr. Azedine Beschaouch, ICC Standing Scientific Secretary

"Honourable Co-chairmen,  
 Excellency Mr. Sok An, Deputy Prime Minister, Head of the Cambodian Delegation,  
 Excellency the High representative of His Majesty the King,  
 Honourable Ministers,  
 Honourable Governor of Siem Reap,  
 Dear Colleagues,  
 Ladies and Gentlemen,

May I first recall that internal regulations have been adopted regarding the activities of the secretariat? These long-awaited regulations enable more efficiency in three specific areas, which are as follows: the administrative, technical and scientific fields. But I would like to express the honour for the secretariat and especially for myself when His Majesty the King of Cambodia granted an audience to our committee, on the international level to both Co-chairmen of the technical and plenary sessions, to our secretariat and to the APSARA Authority. Our delegation received by His Majesty was headed by HE Mr. Sok An.

It was on the morning of January 28, 2009 that we had the privilege to submit to His Majesty the progress made by the community of scholars and conservators seeing to the development of Angkor. His Majesty was satisfied to find out that in Angkor there still reigns what His Majesty the King Father had wished when this Committee was set up, and which was started when decisions were implemented after the first founding meeting in Tokyo in October 1993.

His Majesty King Sihamoni, in the footsteps of his father, continues this tradition and therefore granted us an audience this year; this is when we had the privilege of handing him out our report.

You are now familiar with the outlines of our administrative duties, which include the drafting of the report. I would also like to remind you that a full report of the 15<sup>th</sup> session, chaired by HE Jean-François Desmazières and HE Koïchiro Matsuura and held in December 2008, will be shortly distributed. This report, in French and English, is for your submission. The previous report on the 17<sup>th</sup> technical session held on June 4-5, 2008 was well received, with comments reviewing these reports as accurate and sincere. These reports not only present the papers but also the discussions of the whole proceedings, and I would like to highlight that this huge administrative work takes a lot of the time of our Secretariat. This work can only proceed thanks to the support provided by the UNESCO office managed by my colleague Teruo Jinnai, the representative of UNESCO in Cambodia and of his director.

There is a novelty to announce: following an urgent request from us and that HE Mr. Sok An, Deputy Prime Minister and Chairman of the APSARA National Authority granted. We wanted our proceedings (papers and discussions) to also be available in the national language, Khmer. So, besides the reports in French and English, there is also a report in Khmer which has been distributed to the relevant ministries and offices, to the National Commission of UNESCO and to the APSARA Authority. We continue to enjoy this task and our Co-chairmen from the technical or plenary sessions always ensure that the national language Khmer is available. As you now know, not only in writing but also orally, as was the case during the last session, everything we say is now translated into both working languages, French and English, and also into Khmer.

The second part of our work is technical and you are all familiar with the scope of it. Decisions recorded in the report must be followed-up and we all see to this monitoring: Mr. Philippe Delanghe, head of the Cultural department of UNESCO in Phnom Penh is in particular involved with Angkor, as are his colleagues such as Mrs. Chau Sun Kérya, outsourced by the presidency, who is responsible for the relationships between the national and international sections. This then ensures a follow-up between both sessions.

Earlier-on the Co-chairman recalled the recommendations, which are of two kinds: technical to make sure that there is continuity after the *ad hoc* experts visit the field and the recommendations they propose to the teams. We then all visit the working sites to monitor progress and to remind our international colleagues that they must follow the recommendations of the experts. This part of the work is going smoothly. We must keep in mind—as mentioned by Mr. Sok An—fair-play and dialogue. Since the time of the meetings in Egypt—and Professor Bouchenaki deployed a lot of effort to see to my involvement in international meetings—I can assure you that there are no equivalents to the meetings held in Angkor at the international level. So let's congratulate each other and keep up the good work; this needs to be said as very often only the criticisms are looked at—although they remain useful to prevent us from resting on our laurels—but again it is nice to say that year by year things are improving.

On this point we are answering the appeal of HE Mr. Sok An, the Deputy Prime Minister, that we, the secretariat, and the *ad hoc* experts will assist in providing accurate information. This task will be done. I also would like to remind you that before February 1, 2010, a full report shall be submitted to the UNESCO World Heritage Centre, in order for the World heritage Committee to assess the management of Angkor.

This management is comprised of three main components. The first insures the security and integrity of the site. Several times, my colleagues and I from the secretariat have attended meetings with the APSARA Authority, and I can testify that there is a Public Safety Department, headed by a General, a point which is of importance. In Italy—and Mr. Bouchenaki can talk about it better than I can—there is a national troop called the *carabinieri*. They are in charge of protecting and guarding the people in historical monuments and heritage sites. Here in Angkor something similar is developing and becoming more efficient, thanks to the work of HE General Dom Hak and his team. We went on site to monitor the situation and I can personally testify that over 40,000ha there may be some violations. When we visited the site, some unacceptable buildings were to be seen which even in a non-World Heritage site would have not been suitable, and we have pictures to support this. Following an initial feeling of sadness, which we will report on later, we took the decision, which was then implemented by the APSARA Authority, to dismantle these buildings. I went there two days ago to monitor it. The pictures will be available in the report. I can then say that your secretariat and not only yours truly but all of my colleagues, are visiting the site on a regular basis to follow-up an efficient monitoring of the works.

The last component is of scientific value. Every time it is needed we assist the APSARA Authority and its Departments, in particular on recurrent issues such as the water issue and its preservation. And, as mentioned previously, the Department of Water and its director Dr. Hang Peou are convinced of the success of the refilling in water of the northern baray. It is the task of the secretariat to inform the international community of this progress. This has been done. Every time I can, and within academic environments such as ICCROM or UNESCO, I inform on the presence in the APSARA National Authority of researchers, meaning that not only are there technical activities, but also scientific ones. All this work is monitored by our secretariat. Many things need to be reported on. And the recording of the proceedings does not only cause the sheer size of the report but also observations and monitoring. Many other things could be added but reading this report will help you to be better aware of the work of the secretariat.

I would like to warmly thank my colleagues, the UNESCO office in Phnom Penh. I would also add that this work could not be carried out without the trust of our co-chairmen

of the technical and plenary sessions, of the APSARA Authority and of the great trust shown by Mr. Sok An, Deputy prime Minister and President of the APSARA National Authority”.

## **II.2 APSARA National Authority General Activity Report, by HE Mr. Bun Narith, General Director**

“Excellency Mr. Deputy Prime Minister, President of the APSARA National Authority,  
Honourable Co-chairmen,  
Excellencies  
Ladies and Gentlemen,

We are gathered here for the two-day proceedings of the ICC’s 18<sup>th</sup> technical Committee: research and conservation are today’s topics and tomorrow’s agenda will continue this topic and end with sustainable development.

ICC meetings have been going on for 16 years and all the distinguished experts that have been collaborating since then are still among us! Some of the early participants are also attending, showing their support to the works on Angkor and I am convinced that it is still the same enthusiasm that sparks their attendance and the same motivation that triggers their interests.

I would like to take this opportunity to pay tribute to Professor Hiroyuki Suzuki, the Japanese expert from the *ad hoc* group for conservation. After years of faithful contributions the Professor has retired from Tokyo University and from his work as an expert of the ICC for Angkor. Let’s wish him a peaceful retirement, as he has decided to dedicate his time to teach in another Japanese University. On behalf of the APSARA National Authority, and on my own behalf, I would like to thank him deeply for his commitment to the safeguarding of our national heritage. I also take this opportunity to officially send a request to the Japanese Embassy represented by the Co-chairman, H. E. Maruyama, to continue the technical assistance to the works in Angkor by appointing a new expert for conservation. I have also just been informed that Mr. Maruyama will be leaving us and that today is his last ICC. May I wish him all the best and success in his new posting? I would also like to present to him my gratitude for the very active role he played during our meetings.

I would also like to greet all members of the national and international delegations attending this meeting, highlighting the faithfulness of two friends from Angkor and Cambodia: Mrs. Francine d’Orgeval from the French Ministry of Foreign Affairs and Mr. Bruno Favel of the French Ministry of Culture and Communication.

Welcome to all national and international guests participating in the 18<sup>th</sup> technical committee, in particular to Professor van Baelen, guest of the Royal Government.

I will now summarise the numerous and sometimes complicated activities of the APSARA National Authority. I have chosen to divide my presentation into two parts, conservation and development, following the ICC agenda in order to ease for newcomers the understanding of the missions, often very different from all the Departments.

### **HERITAGE AND CONSERVATION**

In the last progress report presented at the last plenary session in December 2008, I informed you of the replacement of four broken or missing statues on the South gate of Angkor Thom, handing back to the causeway its historical dimension. Restoration works on a further ten heads will start soon and when ready they will replace the missing ones and will contribute to the grandeur of the causeway.

Rehabilitation works of the first stage of the building and of the outstanding wall paintings of the 80 year-old Bakong pagoda have been completed, thanks to a US\$90,000 financing from the Swiss company Holcim. An archaeological, architectural and structural survey of the Wat (temple or pagoda) was carried out during the restoration works of the outer wall paintings and on the painted panels along the galleries and the veranda. The restored painted panels were dismantled to be safely stored during demolition and reconstruction of the galleries. The second stage will start in one month, supported by an additional US\$100,000 donation from the Swiss Company Holcim. The invitation to tender is being prepared in order to select the company in charge of the restoration works. The third stage, still awaiting financing, will consist of the restoration of the inner wall paintings and of those located on the ceiling of the temple. Then, a Buddhist museum will be created.

The building of the ceramic museum of Tani is completed, the land is being developed and the items to be exhibited are being installed. If the works proceed as planned, the inauguration and public opening might be planned for next December, during the next ICC plenary session.

Measures taken to stop illegal activities of different kinds in the Angkor Park have been strengthened following the setting up of a mobile intervention unit to carry out regular patrols in protected zones 1 and 2. Regular meetings with the local authorities are organised to reinforce the cooperation on the territorial level: this to diminish, if not eradicate, new illegal constructions.

Researchers of the APSARA National Authority will start further studies for the "Living Angkor Road" project on the road leading to the site of Wat Phu in Laos. I would like to highlight that this new stage of the project is carried out only by Khmer archaeologists within the framework of the development of the Sras Srang site and more detailed studies on ancient roads.

Finally, the APSARA National Authority, based on its experience acquired in the field and in terms of safeguarding and maintenance, was able to outsource several qualified technicians to assist the National Authority for Preah Vihear.

## **HERITAGE AND SUSTAINABLE DEVELOPMENT**

I am delighted to announce that the APSARA National Authority has started work on the construction of its headquarters and backfilled the land of the Visitors' centre located in the Cultural and Tourism City. The new offices will group all Departments in order to facilitate a more efficient collaboration, whilst also providing substantial savings on travel expenses. The visitors' centre will be equipped with all the facilities necessary for managing tourism and to showcase the values of the Angkorian culture and civilisation, whilst being used as a centre for the other satellite centres located in the parvis of the monuments, and provide visitors with a reception up to the standard of a World Heritage site. This centre will also play a central role for reducing traffic issues in the Angkor Park and for regulating visitor flow in the monuments.

Major infrastructural works have been undertaken: starting with the construction of 15km of new roads south of Siem Reap town; these works are 90 per cent completed. The last part consists of the construction of a bridge crossing the Siem Reap River, still to be completed.

Works also concern repairing and showcasing the 3,650m long roads along the moats of Angkor Wat, including the construction of a sewage system all along the roads. These works have been completed.

Further on, two 15km roads bypassing Angkor were built. The Korean Development Agency (KOICA) financed the construction for US\$4 million.

A new 30m long by 7m wide bridge was built in Banteay Srei, to replace the old bridge which had collapsed due to overloading; these works have recently been completed. Adding to this was the improvement of two stretches of road from the bridge to the Angkor Park and to the Banteay Srei site.

Before ending on this subject, let me remind you that maintenance and road repairs in the area of the Angkor Park and in the Cultural and Tourism City are constantly carried out.

Finally, electric posts were erected on the public roads from the ticketing booth until the road leading to the Angkor site, up to the junction in front of Angkor Wat and on the Commaille road; this is to improve night lighting.

Community development works: the implementation stage of the bilateral civic participation project with New-Zealand has started. Three experts have arrived and will collaborate with the APSARA National Authority Officers. Two villages have been selected for the six-month pilot projects: the Sras Srang North village and the village of Rohal. The achieved outcomes will be assessed and will serve as a base for the final decision regarding the continuity of the five- year project.

Development works of the Run Ta-Ek eco-village have started. A water reservoir has been dug, an access road built and the plans of a model village drawn. This large scale operation undertaken by the APSARA National Authority aims at encouraging young couples starting a family and who have been living for many years in the protected zone of Angkor, to leave their parents' homes and settle in this village.

Northern baray rehabilitation works: the water gates to fill in the northern baray are being built and will be completed in three weeks. The water gate located on top of the dyke will collect and manage the water to be used by the population. The construction of sewage systems in two locations will create crossing points for the residents in the water collection areas of the northern baray. The Deputy prime Minister and President of the APSARA National Authority have approved these three construction sites; work will start next week.

The sustainable development policy set up by the Royal Government for the Angkor site has been implemented following the start of an ecological means of transport: electric cars for the Angkor site and especially in the precinct of the City of Angkor Thom. This new transportation system will contribute to a decrease in gas emissions which are toxic for the environment and impact negatively on the Angkor site's monuments. The world economic downturn has affected Cambodia, as is illustrated by a decrease in the amount of visitors. Figures show an overall decrease for the first four months of this year of 21.85 per cent year on year.

In terms of cultural development for tourism service, I am proud to announce that the remaining development works on the Banteay Srei parvis are almost complete and that the parvis will soon be officially in full operation. The different stages of the projects were presented during previous technical committees. The project manager in the "sustainable development" section of the agenda will present the details of the operation. The Banteay Srei parvis was officially inaugurated on March 16, 2009 under the chairmanship of HE Mr. Sok An the Deputy Prime Minister, President of the APSARA National Authority and H. E. Mr. Imhof, Swiss Ambassador to Cambodia. Also attending was Mr. Yai, President of the Executive Board of UNESCO, who honoured with his presence the inauguration ceremony. A fully equipped visitors' centre and an interpretation centre, showcasing the cultural assets of the temple, have been built amid an authentic landscape. The commercial area was built to facilitate the strong involvement of the local community and the surroundings of the monument were developed as integrated components of the monuments. Visitors will no doubt venture into these areas, once the visit of the temple is over, to get a better feel of the quiet atmosphere around the monument and to admire the staging as wished by the creator. Let me invite you all to visit Banteay Srei and to send us your feedback, such as advice or ideas to improve the development of future parvis for other monuments.

Miscellaneous activities: notable is the creation of a spice garden by the APSARA National Authority, developed on almost 3ha and located in front of Siem Reap's Teacher Training College. In terms of the future development of open spaces, the creation of a botanical garden is foreseen.

Local authorities, and especially HE Mr. Sou Phirin, the dynamic governor, are working for Siem Reap town. Rainwater collection and drainage systems are to be improved, as well is wastewater treatment, thanks to funding provided by, among others, the French Development Agency (*Agence française de Développement*, AFD) and the AIMF.

To end on the subject of sustainable development, I am delighted to inform you that in line with its effort to protect the environment, the APSARA National Authority and all its Departments which staff was trained to ISO 14001 procedure, have received certification and that it has been successfully renewed.

Finally, I would like to bring to your attention the fourth water colloquium held yesterday and its recommendations, which will be soon available. Thank you for your attention."

### **II.3 Presentation by JASA (JAPAN-APSARA Team for Safeguarding Angkor): Safeguarding of the Bayon Temple**

#### **a. 1. Interior laterite structure of the platform, by Dr. Kou Vet**

[OrigE] [slide] Thank you Prof. Nakagawa, Mr. Chairman, His Excellency, Ladies and Gentlemen Good Morning. I am Kou Vet, of the JASA Archaeological Staff. I am very pleased to show my presentation on the "Structural Behaviour of the Southern Library of the Bayon Temple". The structural behaviour here is only on the structural construction of the foundation of the tower building of the monuments. As we know that on Khmer architectural monuments, the towers stand on the platform which is created by compactly tamping sand as the foundation and around surrounding stone elements, such as typically seen in the Tower N1 of the Prasat Suor Prat, and the Northern and Southern Libraries of the Bayon Temple. However, we have not seen a structural construction inside the foundation mass, except for the laterite square wall found inside the foundation of the Southern Library of the Bayon Temple. Up to now, there has been very little investigation of this phenomenon because it was assumed that the soil disturbance was due to clandestine digging at the temple as acts of pillage, therefore not warranting further evaluation. Today, I would like to report the results of the archaeological survey from 2007 to the present on the inner structure of the Southern Library of the Bayon.

Before I start talking about the Southern Library of the Bayon, I would like to briefly explain the foundation of Tower N1, one of the 12 towers of the Prasat Suor Prat group, and the Northern Library of the Bayon. First, let me show the location of the monuments.

[slide] This is a view map of Angkor Thom. [slide] Here is the Prasat Suor Prat and [slide] here is the Bayon temple. [slide] Here is Tower N1. [slide] Here is the map of the Bayon complex. This is the Northern Library and Southern Library of the Bayon.

[slide] Here is the view of Tower N1. The above 2 pictures are the view of the tower before restoration; and below is the tower during dismantling and excavation. [slide] Here is the North-South section view map of Tower N1. Light orange colour indicates the foundation mass. This foundation mass was formed by sand tamping alternating with broken stone fragments which was contoured by the wall of the platform.

[slide] This is a view of Tower N1 after completed restoration in 2005.

[slide] Here is a view of the excavation at the northwest corner of the Northern Library of the Bayon. Here is a view of south section map of the Northern Library. Yellow is a part of foundation mass. The method of construction of this foundation is similar to the foundation of the Tower N1 of the Prasat Suor Prat. Only the materials are difference.

From now, I would like to talk about the Southern Library. [slide] Here is a view of Southern Library. The black and white picture is the original building, the other two pictures are the library being dismantled and under excavation. Here is a view of the south section wall of the Southern Library. The yellow shows digging to the foundation mass of the building. We considered that both materials and method construction of the foundation mass of the Southern Library are the same as at the Northern Library of the Bayon. Orange colour is the structural construction of laterite wall inside the foundation mass. This is the view from west. Yellow indicates the foundation mass. Orange indicates the laterite wall inside the foundation mass. It was found between the upper and lower platforms of the building.

The survey showed that there are possibly two laterite walls constructed inside the foundation mass below the upper platform of the Southern Library.

The two laterite walls are, [slide] please look at this map: orange indicates one laterite wall construction element at the western part and another at the eastern part below the platform of the building. The eastern one was confirmed by hand auger test, therefore the exact shape of this structure is unclear.

The one at the western part was formed as a square box without cover or bottom. Its size is 360cm (N-S) x 360cm (E-W), and the height is 170cm (with 7 tiers of laterite blocks). The inner part of the square box was filled with tamped soil mixed with broken stone fragments which is similar with the soil used for the foundation of the library building itself.

Nevertheless, as nothing has ever been reported about this type of structure inside the foundation mass of a platform, further studies must be made to clarify its function and other issues.

Whether a similar laterite wall exists in the Northern Library is unknown, because the archaeological survey at the Northern Library did not excavate as openly into the compacted soil of the platform as in the Southern Library.

[slide] Conclusion: the towers of Khmer monuments were constructed by tamping sandy soil mixed with broken stone fragments to act as the foundation. The foundation itself was surrounded by a wall contoured to the platform. However, the laterite structural construction seen inside the foundation mass of the platform of the Southern Library is a very special case among Khmer monuments. Due to the lack of understanding of this structural element, its function will require further study in the future.

[slide] Thank you very much for your kind attention to my presentation."

## **a. 2. Trial assembly of the upper structure, by Mr. Soeur Sothy**

[OrigE] [slide] Mr. Chairman, Excellencies, Ladies and Gentlemen, good morning. Our work followed the restoration policy and techniques applied at the Northern library of the Bayon. However we improved some areas following experiences gained from the restoration of the Bayon and Prasat Suor Prat.

I will now go through some slides and will not read them as I can explain to you through them. Our project lasted five years. We started in 2006 and will finish in 2011. [slide] This diagram shows you the continuity of the work over the years. The dismantling work only implies parts of the structure which are clearly displaced. [slide] This work started

in January 2007 and finished in December 2008. The upper structure, upper platform, part of the fourth platform corner, and part of the foundation were dismantled.

[slide] On this map, you can see the dismantled areas. During dismantling we carried out a detailed recording and this year created a data base system with the documents and survey. During the dismantling we carried out tests in different fields, such as geotechnology, stone conservation, and other tests which are still going on. [slide] These are items found during excavation. In the centre of the southern library we found the figure of a cow and a chisel. This is the work carried out on repairing the stone. JASA attempts to re-use original material as much as is possible and to repair broken sandstone elements. However, the use of repaired elements may compromise the stability of the structure. [slide] We have also created a very important database system to record and install all the activity before, during and after repair, for example by drawing or photographing, as in this picture.

We carried out consolidation of the stone, fixing and making new sandstone or laterite. We also proceeded with a trial assembly where we attempted to find the right adjustment between dismantled and non-dismantled parts. [slide] As you know, we keep some parts, hence the trial assembly. You can see the condition of the structure before and after in the picture below. It took us about one year to complete this work. [slide] After the trial assembly we found some vertical and, in red, horizontal distortions. The structure fits outside or inside the axis. We tested some of the layers to confirm the original layout of the structure. [slide] This is the reconstruction work now. It was conducted in January this year and is very important in order to improve the soil foundation. [slide] To reinforce the foundation we use slake lime, red soil and sand for consolidation of the foundation. [slide] These are activities to create the product using red soil, lime clay. Compaction work during reconstruction is also done, to confirm that the compaction is satisfying. Again, recording through photographs and drawings was done for the data base system. This is the end of my presentation. Thank you."

## **b. Research on the central tower foundation structure, by Mr. Shimoda Ichita**

[OrigE] \v[slide] I'd like to report on the results of the survey of the foundation structure of the central tower on behalf of Dr. Iwasaki. JASA carried out the several excavation surveys in the central group of the towers at the Bayon from 2008.

[slide] In the central tower, an excavation survey of the central shaft was conducted by Trouve in 1933. He excavated to a depth of 14m from the floor level, but the survey was stopped by underground water. This level did not reach the natural ground layer. He confirmed that this shaft had already disturbed in the past by looters. This survey is familiar because of the unearthed main Buddha statue of the Bayon temple.

After the excavation survey, this shaft was immediately filled back to a 2m depth from the floor level by Trouvé, and then 2 years later, filled back until the floor level by Marchal.

[slide] Recently, we conducted three excavation surveys and a boring survey from 2008 to 2009. The main aim of this survey is the study of the foundation structure beneath this central tower. We expected that some supporting structure will be confirmed under the wall. Firstly, the excavation survey at the north-west area in the central chamber was conducted on August 2008. Then, western rooms were surveyed, then the north-east area of the central chamber. Lastly, a boring survey was conducted at the rough centre of this main chamber.

[slide] These are scenes from each survey. [slide] This is the North-South section after the excavation survey. We dug to a depth of 2.25m. Upper 2.25m level is the filling back with pebbles by Marchal, and the lower layer was filled with loose sand, probably by



Trouvé. Under the wall, one layer of sandstone and one or two layers of laterite blocks were confirmed, and beneath of them, only compacted soil was found.

[slide] We confirmed several areas of the existence of supporting structure beneath the wall through horizontal hand auger tests. However, we confirmed only compacted soil under the wall. It means this 42m high central tower is standing only on compacted soil.

[slide] Through this survey, we found a water channel called Somasutra on the north wall, which extends to the north-east. [slide] This direction is the same as that of the outlet on the platform that has been confirmed before.

[slide] Well, by this excavation survey, we confirmed the very loose backfilled soil by the previous excavations. Stability problems were suspected due to the relative density of the backfill. A boring survey was planned to study characteristics of the soil.

[slide] In March, 2009, JASA performed geotechnical boring down to 20m below the surface. Based upon the result of the boring study, the man-made fill was confirmed by the recognition of laterite chips to a depth of Ground Level -14.4m. The fill was divided into two parts. The shallow part of about 13m is very loose state with Standard Penetration Test  $N=2-5$  and the rest of the deep part is a medium density Standard Penetration Test  $N=25$ . The upper loose layer corresponds to the vertical shaft excavated in 1933.

[slide] It becomes clear that the refilled soil is very loose compared to the original compacted fill in ancient times due to the poor practice of back filling. Stability of the foundation is to be discussed in terms of geotechnical engineering.

[slide] The top filled mound base on which the central tower stands was assumed to be an axis symmetric model.

[slide] Plan of the central chamber; oval shape of the plan. [slide] Again, this is a section at the bottom of the wall of the central tower. Sandstone and Laterite layers were confirmed under the wall.

[slide] We analysed the foundation structure using the FEM model. The most important values among the parameters for this analysis are deformation and strength characteristics of the compacted fill.

[slide] We found interesting traces during the restoration work in the *Prasat Sour Prat*. When we excavated the compacted foundation soil under the tower, many scratch patterns were confirmed on the trench wall.

[slide] We recorded and measured the angle of these scratch patterns and calculated the average as 30 degrees. From these scratch patterns on the excavated surface, the frictional angle of the Khmer (ancient) compacted soil was estimated as 30 degrees.

[slide] For estimating the mechanical characteristics of the compacted fill, we applied the data of the plate loading test. The in-situ plate loading tests are evaluated as non-linear stress-strain with Mohr-Coulomb failure criteria.

[slide] We tested using several different diameter plates, such as 10cm, 15cm and so on. [slide] This is an estimated mechanical characteristic of the compacted fill. [slide] Vertical load from the tower was divided into five parts as shown in this diagram. Backfill material at the centre is neglected due to very loose state.

[slide] This is the result of the stress distribution in the foundation mass of the vertical component around the central tower. Just beneath the applied load, two layers of stone/laterite blocks of 30cm thickness are modelled. The left side shows the estimated Stress state before the excavation in 1933. The heavy load on these layers tends to spread into the fill mound. The right side shows the estimation after the excavation and loose

back fill shaft. During the excavation of the vertical shaft (diameter 2m), very large stress redistribution was obtained in the fill beneath the central tower. The stresses at the wall surface of the excavated shaft become extreme values.

[slide] This, then is the stress distribution of the radius component. By the excavation and loose backfill soil, radius stress becomes zero. The present safety of the shaft is like a vertical tunnel without any lining that protects the tunnel wall. In the future, the loosening of the original fill is inevitable and the foundation is likely to collapse.

[slide] The tangential component becomes very large and shear failure takes place. [slide] The yielded zone expands outwards, 2-3m from the shaft wall. On the outside of the yielded zone, concentration of tangential stress was formed and induces a strong ring stress that keeps the shaft space from collapsing. However, the ring stress is very unstable since the inside of the excavated shaft was filled with very loose fill.

[slide] Conclusions: the backfill was found to be very loose state by the bore study. Excavation has caused stress distribution in the foundation soil. Due to the decrease of confining stress, the shaft wall within 1m from the excavated surface has yielded and is in a very unstable state. It is necessary to adapt such countermeasures to increase stability as to replace very loose backfill with compacted soil or supporting elements. Thank you very much."

### **c. Research on the bas-relief conservation method, by Prof. Dr. Nakagawa Takeshi**

[OrigE] "I will make a presentation about the aims and issues in this field, not as a specialist but as JASA.

There are three annexations of summary that described the major present issues, one by each expert. There are some special features that make the Bayon different from other monuments. For example, the enormous sculpted faces, spaces and configurations of three-dimensional Mandala that give us a sense of a densely compressed and concentrated energy released in one burst, which is created by the jungle of towers surrounding the central tower, the complex gallery and so on. Moreover, bas-reliefs engravings depict diverse motifs that include not only the three major religions of the time but also a mixture of various native Gods, ancestor worship, and what's more, aspects of the life of common people. Above all, it has been noticed that the bas-reliefs of the Inner Gallery are a very important factor in revealing the Bayon's religious character and the background of its foundation.

Whereas the outer gallery can be comparatively easily kept in a dry condition, the present state of conservation of the bas-reliefs of the inner gallery are in the most serious condition of any in the Bayon. The complicated structure of the bas-reliefs of the inner gallery of the Bayon near to the central terrace have caused several problems, such as the collapse of the roof, inclination, distortion, deterioration and ongoing damage to the structure and stone itself. Also, there are many patterns of infiltration and stagnation of rainwater. Thus, in addition to a considerable degree of deterioration, it shows various kinds of damage, as well as colonisation by microorganisms and fungi. Even single stones display varying states of deterioration. Our duty is to face these problems. Regarding the deterioration of structure and stone, we have been working not only in the field of preservative science, but also the fields of Architecture, Geotechnics and Petrology. In order to solve diverse problems, it is necessary to cope with these issues in an integrated fashion. I would like to mention some studies in progress.

[slide] 1.Documentation of the bas-reliefs [slide] Documentation of microorganisms on the surface of the walls, deterioration and damage condition by photo survey, line art, 3D geometric documentation using laser range sensor, and spectral image analysis

2. Investigation of stone deterioration mechanism.
3. Developing a suitable restoration material and study on construction techniques in the inner gallery of the Bayon.
4. Technical transfer, cultivation of Cambodian specialists and engineers in such fields and collaboration with GACP team.
5. Study on making use of the research achievements in conservation and restoration implementation, education, and tourism, with matching conservation.

As you can see it, developing analysis methods of documentation, investigation of deterioration causes and mechanisms, developing a suitable conservation material and construction technique and wise use of all of the above will require persistent investigation, so it need not always proceed smoothly. But it's necessary to continue this work and research step by step with the utmost efforts for the permanent conservation of the bas-reliefs that is indispensable to the Bayon, as the preservation of the Bayon itself. <sup>[slide]</sup> I will explain some research in a straightforward way for each expert about spectral image analysis of microorganisms. We have developed a novel imaging system to measure the spectra of bas-reliefs which is able to obtain a more detailed level of data on biological colonisation. <sup>[slide]</sup> These figures show variations in the quantity of phycocyanin (one of the photosynthetic pigments of cyanobacteria) of around 600nm. We consider that the change in the amount of phycocyanin may relate to the reproductive cycle of cyanobacteria.

#### **4-3. Investigation of biodeterioration**

<sup>[slide]</sup> The latest issue is the analysis of the PCR-DGGE method to ascertain the structure of the microbial community of the deteriorated stone surface based on the genetic information of the ribosomal RNA gene.

#### **4-4. Conservation and restoration surveys and research**

##### **4-4-2. Surveys and research**

We commenced a weather resistance test on reinforcing agents and water repellents, with the objective of developing a suitable restoration material for the bas-reliefs in the inner gallery of the Bayon. The evaluation of the atmospheric-exposure-test is planned to begin in the summer of this year, after two years have passed after disclosing a sample under test

Please see the attached summary of the technical survey data and the annual technical report of JASA. I would appreciate getting your opinion from JASA. Up to the end of this year, or next March, I would like to hold the Bayon symposium including the issue of its central tower.

One more new project is replicating the image of the Bayon. After the death of Jayavarman VII, the principal image of the Bayon was destroyed and thrown into the central well of the temple, as all Buddhist imagery was also destroyed. In 1933 it was excavated and restored by the EFEO and today we can see it at the small temple of Preah Vihear Pram pi Lvên located on the corner of the Royal Plaza near Bayon. There is a school of thought that says that this original image should be enshrined in the main chamber of Bayon. Pieces were assembled by mortar and restoration material, but it is impossible to carry it to the main chamber without dividing it again. Many people have preserved the thought that the EFEO should have enshrined it there and we think that history should not be disregarded. Therefore we would like to replicate the image that is divided into parts, which conform with JSA and JASA's ideas for restoration and preservation of the Bayon and our wish to continue the preservation of the Angkor monuments together with Cambodians.

We would like this effort to be under the direction and cooperation of UNESCO, the Japanese Embassy and the Ministry of Foreign Affairs in Japan, and to secure the approval of His Majesty King Sihamoni and the Kingdom of Cambodia's Government. Fortunately,

masons belonging to JASA have the skills to undertake this grand project. We plan to ask both Japanese and Cambodian stone sculpture experts and Japanese traditional masons to cooperate with our local team. The details of this project are shown in this presentation. Please kindly understand our intent and support this project so that the memory, preservation and restoration of the Bayon by Japan is resumed. We wish to continue the friendship between Cambodia and Japan. Today my presentation is a simple plan of approval to proceed securely. I will formally inform you at the ICC. Thank you very much."

## DISCUSSION

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Question from Mr. Mounir Bouchenaki: <sup>[OrigE]</sup> "I want to ask a question following the presentation made by the JASA team. Firstly I would like to thank them for their very precise and analytical situation of the Bayon. Then I would like to congratulate Professor Nakagawa and his team, in particular by inviting young professionals from Cambodia to present themselves the result of the study. We had the chance to visit the site with Professor Nakagawa's team. On site we were explained the different stages of work regarding dismantling and reassembly of the south library. But the question is about the last question of professor Nakagawa. Is your intention to reconstruct 3-D Buddha statues in the tower or is it a real reconstruction that you would like to carry out?"

Answer from Professor Nakagawa: <sup>[OrigE]</sup> "in the chamber of Bayon we would like to reconstruct. But divided in parts because we need to consolidate the central tower and its foundation in the future, thank you."

Comment from Mr. Azedine Beschouch: "I would also like to make two observations but firstly would also, like Professor Bouchenaki, express my great satisfaction. We are impressed by the details and by this complete support of the monument. My observations are the following. On a more personal matter, I am extremely happy to see that the JASA team continues the work. The Bayon symposium lasted nine years and I was the *rapporteur*. I remember these meetings and several times we requested that excavations shall be carried out in order to ensure the stability of the central tower. We now realise that it is this specific recommendation that enables an accurate chronology but also, as was explained by Professor Nakagawa and his team, to take measures towards definitive stabilisation. The second observation is that we express our satisfaction in seeing that archives illustrate that before they also regretted that no excavations were carried out, but maybe Professor Claude Jacques would know more about it. Well, in 1933, the famous conservator Marchal and also Trouvé, were concerned with this problem. The continuity between these works and those carried out by JASA is another trace of our ICC; not only is it a contribution from each team but also a sign of solidarity. 1933 was more than 70 years ago and now the works are restarting; this is something we shall be satisfied with. Thank you."

Question from Mr. Christophe Pottier: "I will be brief and would just like to ask one question. It is very interesting to see investigations being carried out on the central sanctuary of the Bayon and on its foundation shaft, which, as mentioned by professor Nakagawa and Mr. Beschouch, was excavated more than 70 years ago. I would like to ask if this time any items were found to better date the looting prior to the 1933 excavations. Because the shaft was looted and pieces of this great fragmented Buddha had been thrown to the bottom of the shaft. Is it possible to carry out a more accurate dating in order to know when this looting occurred and even when the statue was destroyed?"

Answer from Professor Nakagawa: <sup>[OrigE]</sup> "thank you Co-chairman and M. Beschouch. Of course we understand that it is a problem to consolidate the foundation structure of the

Bayon and of the bas-reliefs. So I would like to organise again the Bayon symposium and we would like you to attend and to give us your advice."

Additional answer from Mr. Shimoda Ichita: <sup>[OrigE]</sup> "according to our excavation surveys, we have not found anything to help us in dating the past looting. But according to reports from Marchal and Trouvé, it is mentioned that the statue was broken into many pieces and that many fragments were found in a shallow area up to five metres deep. Some parts of the stone fragments were found at 12.5 or 13m. So the stones were very widely distributed. So we were not sure if the illicit excavations happened only once or several times. We have no further information from the excavation survey leading to identifying the dating."

Question from Mr. Walter Santoro: <sup>[OrigE]</sup> "I have a question for Dr. Shimoda relating to the stability of the central tower of Bayon. I remember that during last meetings professor Iwasaki showed some data related to the monitoring system of the tower. Are there now any relevant data about the behaviour of the tower's structure related to the abnormality in its foundation?"

Answer from Mr. Shimoda Ichita: <sup>[OrigE]</sup> "we are in the process of collecting data and some of it is on the tower and others are on the subsidence of the central platform, and micro-waving at the top of the central tower. It depends on the weather. This monitoring system indicates small data of displacement and basically we think that the central tower is stable. We will draft these data in the next annual report, thank you".

#### **II.4 Baphuon: Inventory of fixture and prospects, by Mr. Pascal Royère, architect, EFEO**

"Excellencies,  
Honourable Co-chairmen,  
Dear Colleagues,

Time flies and we are already running half an hour late; as the Baphuon site is the oldest since the start of the international cooperation in Angkor, and as all of you know the technical outlines of the project, I will skip the technical part, especially on the methods for conservation that were set up for this project, and will rather talk about a kind of inventory and on the works carried out and to come.

The last time I presented this project was most almost a year ago, when we were commemorating an important stage of the project with the consecration ceremony of the Great Buddha built in the 16<sup>th</sup> century, a ceremony held under the Royal patronage of His Majesty the King Norodom Sihamoni.

Since then work has progressed on the second and third storeys of the temple. Firstly the restoration of the northern gopura of the second storey, a site which is completed and about which I will talk later. Then, on-going works to restore the western section of the second storey, the same one, located behind the statue of the reclining Buddha. Another site in progress is the restoration of the western pavilion of the second storey

I would like to stress that work is carried out in close collaboration with Professor Hans Leisen's team, which was charged with inspecting then strengthening the bas-reliefs ornamenting the outer walls of this pavilion. I would like to thank them for their contribution. Then, a two phase work to treat the base of the western and southern facades, <sup>[slide]</sup> as shown here, and then work on the finishing. The works consist of reworking the missing parts of the masonry spotted in several structures of the second and third storeys of the temple. This was done on the stairs and string walls of the southern side but also on the paving of the south-eastern courtyard of the second storey. Works also focused on one of the four corner towers of the second storey and on the string walls of the eastern stairs of the main façade of the temple.

Over the past few weeks we have opened a new site to complete the renovation of the integrated decors on the northern stairs of the second storey. A few pictures will illustrate the progress of the works on the different working sites. <sup>[slide]</sup> These are two illustrations, one from 1943, and the one below dating from the early 1960s. They show the northern pavilion of the second storey, which is circled in red, one of the rare structures which survived the 1943 collapse. At that date up to 20m (in height) of façade, the whole north-east corner of the temple collapsed, including the wall bases, the two components of the gallery, with the exception of this gopura. It was preserved and dismantled in the early 1960s.

We carried out the restoration of these structures two years ago, <sup>[slide]</sup> as shown here. This work was delayed last year due to efforts in accelerating the work on the reclining Buddha statue. Teams were moved from this site to that of the reclining Buddha. Work restarted in July 2008. <sup>[slide]</sup> The progress of the work is illustrated here. On the right is the measured drawing of one of the restored façades. Some additional sandstone was needed to fill in the missing parts causing structural issues. <sup>[slide]</sup> This was the case in this picture, when building the support of the copping pattern of the lotus bud crowning the cella of this building. The final result was obtained a month ago once the scaffolding was dismantled. Paving of the inner rooms is still to be done.

<sup>[slide]</sup> Here is a silhouette of this pavilion, identical to those on the other façades, heavily ornamented and also, as for the other façades, presenting elevations with bas-reliefs which, as is the case in the whole Baphuon depicts the episodes of two Indian epics, the *Ramayana* and the *Mahabharata*. <sup>[slide]</sup> This is the western façade, on the northern section of the western gallery of the second storey, located just at the rear of the bust and of the western section of the Buddha, shown here in grey.

<sup>[slide]</sup> This is a picture showing this gallery before dismantling and restoration of the Buddha. This gallery was badly damaged. Not only due to the collapse but also because it was partly damaged during the construction of the Buddha. This gallery had been covered by masonry from the Buddha statue and was also filled in. The inner volume was not accessible, after filling composed of mixed stones carried out in the late 16<sup>th</sup> century, and which aim was to maintain the equilibrium of the gallery, as it was to be covered by the Buddha statue.

<sup>[slide]</sup> This picture is a month and a half old and shows, at the rear of the masonry of the Buddha, the restoration process about to be applied on the moulded base of the gallery. <sup>[slide]</sup> This is the connection and detail of the gopura. Completion of these works is planned for the next five to six months.

Now, let's move on to the centre of the western façade, with the restoration of the gopura of western pavilion II. It is the central pavilion of the second storey, located in the middle of the Buddha statue, which can be seen from the first storey thanks to this big indent. This is the location where the team of Professor Hans Leisen intervened, consolidating these bas-reliefs ornamenting the outer sections of the elevations, <sup>[slide]</sup> such as this one. This pavilion was badly damaged. All of the outer lintels were broken, sometimes into several pieces. Some stone replacements were carried out to ensure a coherent stability for this structure. Dismantling and reassembly were carried out using a slab as a course to distribute the load. <sup>[slide]</sup> In this picture you can see the progress of work, which has now reached the cornices.

As you know this type of work is extremely complex, as there is only one procedure for reassembling such three-dimensional masonry. Sometimes, three to four metres of façade have to be erected in order to be sure of connecting, at the level of the cornices, all of the volumes. This can sometimes lead to several reassemblies and dismantling sessions and can waste some time for this specific site. We have now reached perfect belting at the level of the cornices which make us believe that the works will speed up. <sup>[slide]</sup> In this picture are some of the bas-reliefs which were reassembled and strengthened in the winter of 2009, from January to March.

We are now moving to the structural components, the bases. They are located on the south-west corner of the third storey. This base supports the upper platform of the third storey. <sup>[slide]</sup> There is backfill in this base, as shown in this picture taken in the late 1990s, before the structure was dismantled. These walls might have been the last wall bases still standing but were badly damaged and needed to be dismantled to proceed to the strengthening of the backfill; a drainage system was installed and the elevations were reassembled. This is what was performed on the western and southern sections. <sup>[slide]</sup> Here is another stage of the works, again including new carved sandstone. These were required for structural purposes. I will come back to this at the end of my presentation.

<sup>[slide]</sup> Here are the works almost completed. The paving in the courtyard between the gallery of the second storey and the base of this supporting structure needs to be completed. <sup>[slide]</sup> Here is a picture of the south facade, consolidated on its lower section, where you can see the evolution with the strengthening of the completed upper section. This shows you progress of the works' last week, the reassembly of the upper course is completed; we are now at the level of the third storey at the top. We will immediately start renovation work and insert the necessary new stones to ensure the stability of the wall.

<sup>[slide]</sup> We are reaching the second storey stair of the southern facade. I explained this already, during my last presentation, so I won't tell you again about the technique or about the stones extracted to build the Buddha in the 16<sup>th</sup> century, which triggered collapse and explains why there are several areas with missing parts when performing the reassembly stage of the anastylosis. In that case we added new, carved sandstone. <sup>[slide]</sup> The following pictures illustrate these working sites, here the southern facade. <sup>[slide]</sup> Here in lighter colour the sandstone being added. <sup>[slide]</sup> This shows the sandstone areas redressed and integrated with the original decors. <sup>[slide]</sup> The same in this picture, on the lower section the original decors and added ones which upper sections were newly carved.

The same type of work is being carried out on the eastern facade of the second storey. An inventory was necessary before inserting necessary new sandstones. <sup>[slide]</sup> Here the site at a critical point when stones were being laid, redressed and aged. <sup>[slide]</sup> Finally the completed work as it was a few weeks ago.

<sup>[slide]</sup> This is the northern facade. A similar problem occurred during the major collapse of the western facade in 1971, following the interruption of the working site, when the entire second and third storeys collapsed. These works took longer and were more complex than expected. <sup>[slide]</sup> The whole 20 metres of the collapsed section needed to be taken apart and each storey consolidated, comprising of two walls on each storey, which had then to be reassembled. <sup>[slide]</sup> This picture shows the reassembled second storey and the site on the third storey with one of the courses already restored.

Let's talk about perspectives, the monument is now stabilised and that landslides are not an issue any more, as the backfills up to the third storey are now contained. We are reaching the restitution stage and the issue of the architectural scheme is now raised. Obviously the components of the statue were also extracted for additional masonry on the western facade in the 16<sup>th</sup> century. <sup>[slide]</sup> Adding all these elements showed the limits of the anastylosis, meaning that only some sections of the galleries of the façade could be entirely reassembled. In the other areas, the north, south and west, only some components will be re-erected, such as pillars and the architrave of the galleries. Most of the slabs which were used as roof covering were re-used in the structure of the Buddha.

<sup>[slide]</sup> Here are drawings showing you the deformations that affected the massif. They date back to the 1940s. <sup>[slide]</sup> The base of the central massif is a project within a project. The central tower was never discovered. And with the difficulty in finding stones originating from this tower, it is most likely that this tower was recycled in constructing the Buddha statue. Maybe it was a religious act, an attempt to try to erase any traces of a previous religion. This is probably the explanation for the absence of the remains of this sanctuary. Nevertheless, not everything was extracted and at the level of the paving course of this

central massif, remains can be found: thresholds of doors, traces of plans which assisted in during the restitution stages or at least the restitution of some architectural components; again, a restitution kept to a minimum. These elements can be door frames or some elevated structures of 1/ 1.5 metres in height. <sup>[slide]</sup> When the monument will be seen from afar, the existence of a structure at the top will be visible, while still suggesting its state of ruin and explaining the nature of this ruin.

I am nearly finished. Just to inform you that we will hire more staff from June onwards and that the majority of our teams will focus work on the third storey galleries while continuing the sandstone addition to the lower storeys. Thank you."

Contribution from Mr. Azedine Beschaouch: "Mr. Co-chairman I think that it would be more sensible to keep questions until once we have heard the expert's report. They went on site and will make observations, and that is when we can go further into discussion and ask for questions. But it shall not be a reason not to congratulate Mr. Royère and the EFEO, as this is a remarkable achievement on a restoration work of wide international and national scope. Personally, I am in favour of the scheme taken for the last storey which once again was very well explained, which is only redressing what we are sure of, at least part of the gallery and that the rest will only be evoked by supporting elements and not restituted. We will talk about this after the experts' report and I will personally ask a question. Thank you."

Observation from the Co-chairman for France: "If I understood correctly, the question and answer session is postponed until after the experts' report. We will now take a 15 minutes break to catch up on time."

## II.5 Presentation by WMF (World Monuments Fund)

### a. Phnom Bakheng Conservation Project : Phase II - Restoration of the East Elevation

#### Mr. Glenn Boornazian, architectural conservator, WMF:

<sup>[OrigE]</sup> "Firstly, I will give you an update on the agenda. Chea Sirith is an archaeologist working for the APSARA Authority, not with the World Monuments Fund. We have been working in collaboration with the Authority and I just want to make that clear. It is an honour to be presented to you again. This time we will talk mostly about Phnom Bakeng, with an update on Angkor Wat.

Efforts by World Monuments Fund (WMF) to conserve and present the Phnom Bakheng temple at Angkor began with a grant from the United States Department of State in 2004 with an assessment of the needs and potentials of the site for both preservation and presentation. The initial planning phase of this project consisted of an initial period of research, documentation, urgent stabilisation and testing. This research and planning period provided the opportunity for a holistic and integrated plan to be developed. Teams of international professionals and their Cambodian counterparts in the disciplines of architectural conservation, engineering, geology, hydrology, landscape architecture, forestry and site interpretation conducted a thorough examination of the site and prepared detailed recommendations to the APSARA Authority in the form of a *Conservation Master Plan* that was submitted to APSARA and the ICC on July 5, 2007.

It is important to remember how Phnom Bakeng has changed: over the centuries the temple and its surroundings were thriving and served as an important centre of Khmer life, and then it was forgotten, modified and overtaken by the jungle. At other times, the site was cleared and repairs were made, and then in the 20<sup>th</sup> century for a period of time there were gun emplacements mounted to take advantage of the strategic, commanding view of the airport and the safety of high ground. A large debt of gratitude must be given to the



EFEO for their hard work in documenting and protecting the site over an extended period in the recent past. This work allows us glimpses back in time to what Phnom Bakheng looked like in earlier periods. Today these images are sources for us to understand more recent changes in the general conditions of the temple structure.

The majority of work that was carried out by the EFEO at Phnom Bakheng took place during the 20<sup>th</sup> century. Two main campaigns were implemented: the first from 1923 to 1934 and the second from 1947 to 1948.

During the first campaign, the majority of work consisted of clearing the entire site, the installation of discrete concrete shoring to secure destabilized sections, and dismantling the giant sitting Buddha which was added in the 16<sup>th</sup> century to the top of platform A.

During the second campaign 1947-48, EFEO conservators concentrated on the top of the monument, where large areas had collapsed due to the use of a compacted sand back-fill instead of the typical bedrock that is used in all other sections of Phnom Bakheng.

They started with terrace A, rebuilding the central shrine and then the entire pavement. They then completely dismantled all but one shrine from platform B, in order to add concrete foundations.

Although a great deal of work was done during these periods and sections of the site were cleared, stabilised and reconstructed, this work was carried out in specific high priority locations, leaving other areas considered to be in acceptable condition as they were found at the time. As a result, holistic substrate damage or water infiltration issues were not addressed during that phase of work. Today in addition to overcrowding by tourists, water infiltration is the major threat to the site. Concentrated water behind the sandstone façade continues to threaten the collapse of façade walls, stone shrines, and to destabilise corners on the main temple. The stone terrace pavement is a critical feature for proper water management. <sup>[slide]</sup> The majority of the original pavement is missing and/or separated, increasing the size of the joints or opening between the units and increasing the concentration of water infiltration.

To make matters worse, the stone platform shrines were constructed directly on top of the already installed terrace pavers with their outermost edges bearing on the perimeter wall stone. Given the fact that the stone shrines are stacked masonry, the slightest movement at the base causes much larger openings at the top. This pattern of destabilization causes an unstable top loaded condition which results in accelerated decay and collapse.

The original construction of the platform walls consisted of a simple dry-laid stack of sandstone blocks, built in several configurations, depending on the profile of the underlying bedrock. <sup>[slide]</sup> On the left: sandstone facing built tight to bedrock and in some cases integral with bedrock. Centre: laterite blocks, used to fill space between sandstone facing and bedrock. Right: typical corner condition where laterite blocks were used to infill large spaces between the sandstone wall and bedrock.

The main threats to the platform walls arise from localized wedging failures of the underlying bedrock and water infiltration into the bedrock and behind the walls. The original laterite backing is now heavily decomposed and no longer contributes to the structural system.

To work out the details, materials and methods required to do this work a representative section of wall was identified in Phase I for rebuilding. The wall section chosen as the pilot façade repair and restoration project was located at the southwest corner of the lowest platform level. The final rebuilt wall section included: cleaning, repair and stabilization of the bedrock, installation of new laterite blocks to infill between the sandstone facing and underlying bedrock, careful reconstruction of the sandstone facing with both original and new stones as required, cleaning out cracks in the bedrock filling with gravel and finally the

capping with mortar and installation of new properly pitched sandstone pavers set in a waterproof clay bed on top of a geotextile sitting on the prepared bedrock. In this approach, we worked very hard to come up with in this first phase something that we are applying in the second phase.

Based on the knowledge gained as a result of the completion of the first phase of work and the implementation of a conservation and reconstruction treatment of the South West corner, with additional support from the US State Department, WMF now proposes to initiate Phase II of the *Phnom Bakheng Stabilization and Restoration project*. Phase II will focus on the most urgent challenge at Phnom Bakheng: protecting the temple from further deterioration through stabilization, waterproofing, repairs and partial reconstruction. This phase II will stabilize the main temple's primary East Elevation, the most visible and most heavily damaged part of the site.

Since gaining approval from the APSARA Authority in December 2008, the following tasks have been implemented

**Condition Survey:** a stone-by-stone conditions survey of the East Elevation and the contiguous portions of both the North and South Elevations has been carried out. The result of this survey will provide a basis for defining the various conservation and structural interventions.

**Structural Assessment and Emergency Recommendations:** a structural survey of all the built structures within the project limit line of Phase II has been carried out. Emergency zones in need of immediate consolidation have been identified, and the present Structural Risk Map has been updated identifying high priority areas threatening structural collapse, or that pose unsafe conditions for visitors. The highest priority locations have been addressed by both teams from WMF and the APSARA Authority. To date, 37 locations have been addressed. <sup>[slide]</sup> There are outlines on this image.

**Archaeological Survey:** an archaeological survey and excavation is being carried out by the APSARA Authority under the direction of Chea Sirith in areas adjacent to the East Elevation in order to locate missing stone blocks from walls and to remove the dirt ramp in front of the southern half of the East Elevation, which elevated moisture levels on the abutting original masonry and created a zone of poor drainage. In just a few minutes Chea Sirith will present his work in more detail.

**Restoration of the East Elevation:** the restoration and structural stabilisation intervention will focus on the North and South half of the East elevation. The intervention will be carried out applying methods developed during the pilot program at the South west corner first level. Activities will commence at the northern half of the East Elevation starting from the first level and continuing up to the fifth level. This work will include the disassembly of the stone terrace shrines. This will allow for the proper stabilisation and waterproofing of the area. The second work phase will focus on the southern half of the east elevation and the third will address the central stone stairs and adjacent walls.

**Stone Conservation:** the general needs for stone conservation at the defined project area will be addressed and a more general survey of urgent stone conservation needs elsewhere at the site carried out. Based on the assessment, stone conservation activities will be carried out, accompanying the structural restoration intervention of the East Elevation. In addition, emergency consolidation measures of the carved surfaces at the central shrine on the top platform will be carried out as well. We have had discussions with Professor Hans Leisen from GACP about collaboration on this.

To date, the following site mobilization work has been or in some cases still is being implemented.

There are five phases to site mobilisation:

1. Repair of the pathway up to Phnom Bakheng to facilitate material and equipment transport
2. Work site planning
3. Clearing of the work area
4. Provision of power and water supply
5. Installation of a tower crane

## 2.1 Repair of Pathway

There were three major challenges regarding the repair of the pathway: (1) the reinforcement of two existing small wooden bridges <sup>[slide]</sup> (no. 2 and 4 in the plan above) that were installed to protect the original laterite stairs leading up to the hill, and (2) the short-cut of a very steep and sharp curve (no. 3 in the plan above). The existing pathway was built during military occupation of the site and last repaired by the APSARA Authority in 2005. In order to obtain the required width and strength to facilitate transport of the tower crane (8 tones, 12 meter long) up the hill, the pathway needed to be widened and reinforced at several locations. Wooden posts and planks were installed and filled in with sandbags, gravel, and soil. In order to allow rainwater to drain off several drainage channels were installed following natural water run-off ways.

In order to strengthen the very narrow and unstable Northern Bridge, an alternative concept was developed employing the removal of the bridge and placement of an earthen ramp held in place by large natural stones in metal mesh. This was constructed with gravel and geotextiles to allow water run-off.

The western bridge was reinforced by installation of additional diagonal braces and planks to strengthen the existing structure. All of this work was carried out in close coordination with the team's structural Engineer.

At one place the road curved too sharply to allow for the passing of the crane. In order to obtain a straight path for the transport the curve required modification. The original route was changed and based on topographic measurements and calculations defining slope gradient and length a new straight cut was created.

## 2.2 Worksite and project planning

In advance of site mobilisation measures, careful project logistics were considered and planned for.

WMF worked again in close coordination with the APSARA Authority and His Excellency Ros Borath to design a site plan that would facilitate this work. This included preparation of several technical drawings, engineering calculations and designs, as well as on site meetings with the APSARA Authority.

## 2.3 Clearing Work Area

In preparation for the project, work areas and access ways for equipment and material required clearing. Scattered stone blocks and fragments were carefully documented and removed to safe locations. Clearing site activities were carried out in close collaboration with the APSARA Authority archaeologist Chea Sarith.

<sup>[slide]</sup> Following detailed graphic and photographic documentation of current locations, stone blocks were moved by means of a tripod and chain hoisters, and the employment of traditional stone rigging techniques using rollers.

## 2.4 Provision of power and water supply and preparation workshop/ storage

This was important to us and made difficult due to the nature of the site. The existing workshop has been repaired and extended to house equipment and material for the project. It also contains a small office.

The generator and its related cabling have been installed and a shed has been erected for its protection. A water container will be installed shortly which will serve to store water that will be brought up the hill by car and to collect rain water from the workshop roof.

## 2.5 Installation of tower crane

The preparation of the crane installation involved several planning activities. The technical requirements of the crane with regard to dimensions, reach, lifting capacity etc. had to be identified. Locating, importing, and transporting the crane to the site required a great deal of time and coordination. Based on existing conditions at the temple and its surrounding area, potential locations for the crane placement had to be researched. The process included analysing existing conditions based on plans etc., conducting test excavation, small pits to examine the condition of foundations, and identifying required modifications to the environment in order to place the crane in the most efficient location. As a result of these activities it was found that the optimal place for the crane to be placed during the first work phase is in front of the northern half of the east elevation. In order to place the crane close to the temple in order to reach to the upper platform of the defined work area, the installation of a supporting platform for the crane was required. The platform serves to protect the archaeological remains of a brick shrine underneath it. <sup>[slide]</sup> Following the design of an appropriate steel concrete structure the platform has been fabricated and is being installed on site.

The tower crane will be transported to the top of the hill and installed approximately two weeks from now. The installation will be carried out by international technicians of the WMF team and the crane supplier from Italy, and will be followed by an intensive training program in crane operation and non-destructive stone handling with the WMF's Cambodian crew.

Calculations for the required amount of laterite and sandstone were made and the material has been purchased. <sup>[slide]</sup> Today some of it is at the site and at Conservation Angkor where cutting and fabrication work by the conservation's masons will be carried out.

We estimate that this work will be completed by June 2013."

### Mr. Chea Sarith, archaeologist, APSARA National Authority

<sup>[OrigE]</sup> "Excellencies,  
Ladies and Gentlemen,

I would like to present the results of the archaeological works at the south-east corner of Phnom Bakeng.

The excavation started on February 4, 2009 and is still in progress. The excavation started with trench number one on the East-West axis located at the north-eastern section of the brick shrine. Trench one served as a control for the analysis of stratigraphic layers in order to direct further excavations. In total, 27 sedimentary layers were identified before reaching the bedrock foundation. Interventions included graphic and photographic documentation of each layer and the description of the sediment, debris, and unearthed objects of each layer. Up to now trench 1, 2, 3, 4 and 5 have been opened but only trench number one has been completed.

Due to the unstable conditions of the abutting wall and brick shrines it was decided to remove only the upper layers of earth at one time in each of the trenches to avoid collapse.

Based on the preliminary findings in trench 1, we are able to identify 6 phases of occupation.

The first phase shows the formation of the bedrock being carved during the original building phase of Phnom Bakheng. There are postholes cut into the bedrock which may have been used for scaffolding.

The second phase presents the phase of the temple's construction. There are remains of a laterite foundation and the first course of sandstone for the brick shrine.

The third phase is the phase of destruction, which is marked by the remains of the collapse of the brick shrines. The thickness of 70 – 80cm suggests that there was a massive collapse at some stage.

During the fourth phase it seems clear that a restoration took place as sandstone units were set on top of collapsed brickwork; possibly brickwork from the massive collapse. Due to long periods of abandonment, collapse, lack of maintenance and jungle encroachment it is believed that the surrounding level of earth increased over time. In fact historic images suggest that earth reached the top of the lower platform wall in some locations.

It seems that when the EFEO started work at the site they left this section intact and reinforced for use as a ramp for material transport.

During excavation some interesting artefacts were unearthed. Major findings include gold leaf, a head of a statue and some jars with bones in them.

This is really just the beginning of our work. We think it will take us another 8 months to complete this section. We will document all our findings and update our ideas as new information is discovered. At the completion of our work we will submit a comprehensive final report.

Thank you for your attention"

### **b. Angkor Wat Conservation Project: Restoration of the Churning of the Sea of Milk Gallery**

**Mr. Gleen Boonarzian, architectural conservator, WMF:**

*[OrigE]* "Another five minutes to give you a brief update on where we are with the Churning of the Sea of Milk Gallery at Angkor Wat:

At the last Technical ICC Meeting in June 2008 we presented our work at the Churning of the Sea of Milk Gallery to the Ad Hoc Experts at a site visit and then formally to the ICC. As a result of those meetings, certain questions came up, and working in close collaboration with his Excellency Ros Borath, we made a few modifications to our design *[slide]*:

- We reduced the thickness of the lead sheets to 2mm.
- We reduced the amount of lead significantly, so that now only 2 of the horizontal joints have lead coming to the exposed surface between courses A and B at the top, and E and F at the bottom.

In addition, we inserted some stone shims to insure proper pitch for water drainage. Because we are keeping the passage of original drainage channels open, pitches are essential for proper water management.

As a result of making these changes, we were given formal approval to complete the roof of the entire gallery. To date the pilot project is complete and all phase II stonework

has been documented, emergency stabilised and disassembled. Currently, conservation of this stone is in progress, also in collaboration with Professor Leisen and GACP. Work will continue without interruption and we are still on schedule to complete the project by December 2010.

Prior to taking the gantry crane down we agreed amongst the *ad hoc* committee and the APSARA Authority to stand back and review both interior and exterior aesthetic concerns and make any modifications required prior to disassembly of the crane. We know we have a lot of work to do and we know that there are some places where aesthetically things are working and others where from different vantage point they might not. We will leave the rail of the crane standing to run the full course, so we can get back and address those together.

Thank you so much for your attention.”

Announcement from the Co-chairman for France: “The discussion session is now opened. [The room remains silent for a few seconds]. As no one wishes to take the floor, let’s pass to the next item on the agenda”.

## **II.6 Presentation by ASI (Archaeological Survey of India)**

### **a. Statement by Mr K.N. Shrivastava, Director-General, ASI, New Delhi**

[OrigE] “H. E. Mr. Sok An, Honourable Deputy Prime Minister of the Royal Government of Cambodia and Chairman, APSARA National Authority,  
Other dignitaries,  
Ladies and gentlemen,

India and Cambodia have had a very close association with each other since time immemorial. Both our countries share a common cultural-heritage and the monuments of THE Angkor Park Area, Koh-Ker, Preah-Vihear, East-Mebon etc., stand as testimony to this. The Archaeological Survey of India (ASI) considers it a proud privilege to have been associated with the conservation and preservation of two of these most significant monuments – Angkor Wat and Ta Prohm- for over 3 decades.

The current project of restoration of the Ta Prohm temple complex undertaken by the ASI is indeed interesting and at the same time challenging. It is not a mundane monument restoration project. Here we have to recognise the symbiotic relationship existing between the natural and built heritages and implement the restoration project without causing any harm to this unique relationship. This relationship guides our conservation strategy. One has to keep in mind that this temple is popularly called as ‘Tree Temple’ and this sobriquet must be upheld.

The mandate given to ASI by ICC & APSARA National Authority, from time to time, broadly includes the following works:

Structural Conservation includes:  
Stabilisation of the Western Entrance Gopura of the 5th Enclosure.  
Stabilisation of the Western Entrance Gopura of 4th Enclosure.  
Restoration of the Causeway to the 3rd Enclosure.  
Re-construction of the South Eastern Gallery of the 3rd Gallery.  
Partial re-construction of the Hall of Dancers.  
Reversible interventions at 9 critical locations to arrest further deterioration and to facilitate secure visitor access.

Safeguarding of trees includes:

An Arboriculture Study with a view towards evolving tree to tree prescription for their conservation. And, finally, the formulation of a versatile drainage system, which must consider a hydrological study to determine the causes for water stagnation and evolution of a reliable and sustainable drainage system. The new drainage system must not cause any damage to the trees or to the structures.

Keeping this mandate in mind, the ASI, together with the Forest Research Institute of India (FRI), WAPCOS—a premier consultancy agency in water management of the Government of India, Indian Institute of Technology, Chennai, m/s. Larsen & Tubro has accomplished all the requisite studies, investigations, designs and documentation. My colleagues from the ASI, FRI and WAPCOS would be making their individual presentations on structural conservation, tree conservation and on the proposed drainage system respectively.

I am happy to inform that the ASI has made significant progress in the reconstruction of the South Eastern Gallery of the 3rd Enclosure and restoration of the Causeway to the 3rd Enclosure. At one critical location, in the Eastern Pavilion of the 4th Enclosure, a steel pipe support-system has been installed, providing much-needed stabilisation to the structure and the tree growing over it. ASI has secured the exposed tree roots by providing wooden platforms, steps and walkways over them. A wooden footbridge across the Moat has been built for guiding visitor movement. ASI has also implemented a visitor circulation plan after having it duly approved by the APSARA National Authority.

This august assembly would be delighted to know that the ASI has discovered the original drainage system of the site during the course of its works at the site.

The ASI has made available brochures on the Conservation and Restoration of the Ta Prohm Temple in 5 languages: English, French, Japanese, Korean and Khmer.

Our interpretation centre for the visitors now has information panels on the ongoing project activities.

We had the privilege of receiving the *Ad hoc* Expert Group and ICC officials and conducting their visit to the site on 31st of the last month. We received many valuable suggestions and much guidance from them during the course of the visit for which we are grateful.

Now I call upon my colleagues to make their presentations. I first invite Mr. M.M.Kanade, of ASI, who will make a presentation on Structural Conservation. His presentation would be followed by that of Dr.N.S.K.Harsh of FRI on Tree Conservation, the last presentation would be of Mr. V.K.Gupta of WAPCOS on the Proposed Drainage System.

I thank you all for your attention.”

### **b. Hydrological and structural conservation aspects of Ta Prohm temple, by Mr. M.M. Kanade**

[*OrigE*] “Excellencies,  
Ladies and Gentlemen,

The ASI has been entrusted with the most challenging task of the conservation and restoration of the Ta Prohm temple complex. This project was formerly launched in January 2004 during the Ta Prohm symposium. Since then, the ASI has been working in close collaboration with the National APSARA Authority and under the able guidance of the ICC.

The conservation strategy revolves on the basic concept of conserving both natural and built heritage. Preserving the authenticity and integrity of the site are the bases of all conservation.

A multidisciplinary approach has been adopted and scientific studies and investigations pertaining to structural stability, geotechnical, hydrological and arboricultural aspects of this temple form the basis of intervention.

There are 140 large trees growing in the complex. Some of them are growing on the structure, a situation which has now become landmark of this temple. The roots have entered into the foundation and caused serious damage to the structure. The stagnation of rainwater in the complex is a matter of concern for us.

Geotechnical studies have been indicated at five locations. Soil samples have been tested. <sup>[slide]</sup> This is a trial pit at third enclosure gallery. It shows the foundation consisting of sandstone, a level of laterite course and sand fill inside. <sup>[slide]</sup> This is the soil strata condition. The soil strata are mostly uniform in the temple complex.

Geotechnical findings: soil strata competent and mostly uniform in all the pits. Even where structure has collapsed, plinth walls are intact, meaning that there is no uneven settlement of the foundation due to poor soil condition. Moat edges are well stabilized and there is no slope failure. Stable soils are inside the moat and we do not find any development of silt structure inside.

Structural stabilities studies have been carried out with analysis. <sup>[slide]</sup> This is the entrance gate of the fifth enclosure. This wind analysis shows that at a level of four metres from the top, the area most exposed to the wind. <sup>[slide]</sup> As the wind moves at 85 m/second, there is a possibility of sliding of this section. This is a coefficient friction of just 0.78.

<sup>[slide]</sup> We have carried out gravity load analysis of this studied gallery and there is a concentration of stresses at pillars and junction points. Therefore we are taking special care during the mending of the stones.

<sup>[slide]</sup> Preliminary structural analysis is carried out for this different coefficient of frictions here. We see this compression here in this enclosure wall, and when the friction coefficient is more this compression is at the bottom. At the same time the tension zone changes here. And when the coefficient of friction is less, particularly during the rainy season, there is a sliding failure at this junction. So we are taking special care during our reconstruction so that proper mending is taking place at this strategic location.

<sup>[slide]</sup> This is the eastern gopura. We are carrying out laser scanning for the documentation of this gopura. <sup>[slide]</sup> This is a point cloud image. <sup>[slide]</sup> We are carrying out GPR studies to locate tree roots. We have found that these tree roots are just less than one metre from the surface and that there are hardly any roots beyond one metre. This study is required to locate our pipes for drainage.

<sup>[slide]</sup> We are identifying nine critical locations for supporting our reversible support system. These are the locations. This is the entrance pavilion of the fourth enclosure. It is cruciform in plan. A huge tree is growing on the top of the wall. We are carrying out a detailed, stone by stone documentation. <sup>[slide]</sup> A special supporting system has been designed to take care of the load of the wall as well as the load of the tree standing on it. This consists of a frame and is located at three locations: bottom, middle and top and is supported by a triangular truss.

<sup>[slide]</sup> This is for supporting window openings. Now we have removed these wooden supports used before and provided these tubular supports which are more functional.

<sup>[slide]</sup> This is a very important and famous tree where tourists take pictures. We are providing a platform.

<sup>[slide]</sup> This is the support of the porch of the pavilion which will be replaced with suitable steel props.



[slide] This is another location, a shrine on the central axis of this temple where we are carrying out an FEM analysis. The entire stone section is opening up and this entire portion is leaning.

[slide] This is a plan of the temple. These are the four openings open to the sky. When this preliminary analysis has been carried out, it should indicate the stress level through the entire structure. For this no external forces/load, the analysis is with the structure only and we can see some tensions occur at bottom.

[slide] On this four corner portion, there is excessive stress compression stress and we found crushing of the stone at some locations and tensions in the openings here.

[slide] Then we propose structural monitoring of these critical locations. [slide] We propose to monitor parameter with load changes on the structure, tilt of the stones, linear displacement of stone, changes in crack widths, inclination of the column, wind velocity and temperature changes. This is a flow diagram for structural monitoring system.

[slide] We propose to monitor this tower of the shrine. It is leaning at one side, and we propose to provide tilt and crack meters and to monitor the behaviour of the structure.

[slide] This is the north- west pavilion of the third enclosure. There is a huge tree standing on top of this wall. [slide] At this location we have identified the monitoring of the behaviour of tree with the structure. Due to the width of the trees the cracks have increased and this entire portion is leaning upwards. [slide] We propose to monitor the entire structure with the help of the tilt meter and crack meter. We put forward the use of this cable free instrument for monitoring.

We propose to monitor at least three locations at the same time. The data will be collected in our interpretation centre.

[slide] As this portion is leaning dangerously, we have provided wooden shores to this pavilion. This shoring portion has been provided with inclined shores.

[slide] Currently, we are taking up two locations for reconstruction. [slide] This is a causeway connecting the third and fourth enclosures. The stones have been disturbed here. This is one of the locations where anastylosis is carried out for reconstruction. Detailed documentation of the stone documentation has been carried out.

[slide] This is a photograph of before for documentation. [slide] This is where the dismantling of the plinth wall on either side was done.

Paved by sandstone and enclosed by a laterite casing, the entire backfill has been properly compacted and we will use the same soil distribution for compaction of this backfill. [slide] This section is in progress.

[slide] These broken stone members have been mended. For example this naga railing was in ten pieces. All the pieces have been collected and joined and this naga railing has been reinstated to its original position.

[slide] We are taken up the reconstruction of one gallery. [slide] This gallery was collapsed. This is a photograph before restoration and the entire stone members are lying here. They were documented. [slide] Herewith is the *in situ* documentation of the gallery. [slide] Now a lifting operation is in progress. This is a photograph after removal of the stones. We can see that this plinth portion was largely disturbed. [slide] We are carrying out excavations to survey the stones buried in the surrounding fields.

[slide] During excavations we came across this original drainage system, which can be found on either side. [slide] And we can see the tree roots growing horizontally below a depth

of one meter. <sup>[slide]</sup> This drainage system is now displayed for visitors and will be covered with glass so that visitors can view it.

<sup>[slide]</sup> Pillars and beams have been repaired. We have used all original stone members after mending and only a minimum of new stone mending was provided.

<sup>[slide]</sup> This the plinth portion after resetting. <sup>[slide]</sup> Here pillar bases have been completely mended and reset. <sup>[slide]</sup> This is an example of stone mending. This is a roof stone. It is in three pieces; we have provided reinforcement at the broken edges and we use two types of epoxy and glue. The gaps are filled with polymer cement and stone dust. New stone was provided at missing places.

<sup>[slide]</sup> This is the present position of the construction of the gallery. <sup>[slide]</sup> This is the south east pavilion before conservation. Now resetting is underway.

<sup>[slide]</sup> Now we present some proposals. <sup>[slide]</sup> The proposed reconstruction of the Hall of Dancers is included in our implementation plan. We have carried out documentation of the entire Hall of Dancers. It measures 30 x 20m. It is a huge structure created with the help of walls and semi walls, and there are four openings. <sup>[slide]</sup> We have prepared stone by stone documentation of the walls. <sup>[slide]</sup> Even a 3D model of the reconstruction of the Hall of Dancers has been prepared.

<sup>[slide]</sup> This is the western pavilion of the fourth enclosure which has been identified for stabilisation. This is in dangerous condition so no tourists are allowed in. <sup>[slide]</sup> Therefore a diversion of tourist traffic was provided by means of a wooden bridge erected across the moat. The water level inside the moat is of 45cm.

<sup>[slide]</sup> Now there are four or five dangerously inclined trees, so we propose to provide this external support. <sup>[slide]</sup> It is in the form of a hinge at bottom which can take care of the sway of the tree. It can support up to 20m in height. <sup>[slide]</sup> Some of the trees have to be provided with wire rope guys at an angle of 120 degrees. Thank you for your attention."

### **c. Conservation of trees within Ta Prohm temple, by Dr. N.S.K. Harshm, FRI ( Forest Research Institute)**

<sup>[OrigE]</sup> « Excellencies,  
Co-chairmen,  
Expert members,  
Ladies and gentlemen,

I am here to take you away from architecture and talk about tree conservation. I want to draw your attention to the status of the trees, which are thriving in Ta Prohm temple. <sup>[slide]</sup> But first for those of you who are interested in architecture, I would like to show this photograph of the Forestry Institute Building. Inspired by Greco-Roman architecture, it was constructed from 1923 to 1929.

<sup>[slide]</sup> At Ta Prohm there is a remarkable symbiosis, a harmony between the natural and built heritage which has created an extraordinary co-existence between trees and monument which needs to be conserved for posterity. Visitors come to Ta Prohm to witness this unique symbiosis, which is conducive to the growth and support of biodiversity. The different plant forms, fungi, bacteria, sino-bacteria talked about by previous speakers, then the trees. Some are growing on the ground and some on the stone walls and roofs of different structures. One of the dominating trees is the *Speung (Tetrameles nudiflora)*.

<sup>[slide]</sup> These trees are facing many threats due to high level of human interference and the fact that the root system of the trees is under stress, particularly as many people trample the exposed root system. <sup>[slide]</sup> These photographs show that this statement is true.

These roots are under stress, due to soil compaction under human feet, which results in reduced water percolation and reduced root aeration. Moisture and aeration are absolutely-critical for normal root growth. <sup>[slide]</sup> These exposed roots are not only trampled but they are damaged. These wounds are opened on the tree and invite infection by many pathogens which in the due course of time will kill the tree.

<sup>[slide]</sup> This is to show you how these exposed roots are trampled. Wounds are created and start the decay process.

<sup>[slide]</sup> In addition to the wounds, they also create cavities which fill with rain water, initiating the decay process.

<sup>[slide]</sup> Then, as you know, men think that they are immortal, and if not immortal, they want to remain in history by etching their names. They are damaging the trees and these wounds initiate the decay process, as the holes are then colonised. Here are the names of a few pathogens; for those who are interested, I can tell you something about them.

<sup>[slide]</sup> On the temple premises the trees suffer from two main types of rot. The first is basal rot at ground level, the other is heart rot. You know that the trees have hard wood in the center. That hard wood decomposes behind the cavity. We call it hollowness or heart rot. This rot proceeds up the trees. Affected trees become vulnerable to breakage. Fortunately the root system is such that with spreading they don't become uprooted. But there is always the possibility that such trees will break.

<sup>[slide]</sup> This decay, which starts as a basal rot, extends over the tree. Here you can see the hollowness. An indication is also that whenever there is a swelling, the rotting and hollowness are progressing upwards. So, as shown by M. Kannade, such trees need support. And as the decay progresses, hollowness continues, and you will see that the decay is falling and the tree is in danger.

<sup>[slide]</sup> This is one of the trees which falls into the high-risk category. Mr. Kannade talked about props to be provided for this. <sup>[slide]</sup> We have been studying since 2006 and we have counted 131 trees. Arboricultural and pathological studies were conducted and the age of the trees was estimated at between 82 and 120 years, with the trees being classified into low/medium/high/very high-risk categories.

<sup>[slide]</sup> Inside the fourth enclosure there are 25 trees. Two trees out of the 131 have already died: one has been overgrown by another tree and the other has fallen. 22 trees are categorised as very high risk, 10 as high risk, 4 as medium risk and 95 as low risk. Nearly 35% of the trees fall into the risk category.

<sup>[slide]</sup> This is our work plan, some of which has been completed: additional wooden structures (platforms/ walkways/barricading) will be erected to prevent tourists from trampling on roots and touching or etching names on the trees. Raised wooden walkways have been erected in many sections but are still required at a few critical junctions. Periodic treatment of the decayed portion of the trees by using, eco-friendly materials followed: I will be talking about this later on. Covering of the exposed roots of trees with local soil in different sections and periodic surface treatment with eco-friendly anti-fungal material have been undertaken. Aesthetically suitable wooden props will be provided to support leaning trees. Such props can then be covered by some climbers already present in the temple premises, to merge with the aesthetics and ambience of the natural environment.

Capacity building: training of the staff of APSARA and Water and Forestry Department in maintenance and treatment of the trees. For those high-risk trees that cannot be removed there should be proper signage so that people do not endanger their lives by going near them. This is a measure that we can take immediately. Regular monitoring, of the tree health status for the next two years will be undertaken.

[slide] This is how we are proposing the treatment of the exposed basal rot. This is an eco-friendly material. Fortunately we have found one local material known in Khmer as *chort cheu*. It is a resin obtained from a tree present in Cambodia, a *dicterocapus*.

[slide] Then we propose to fill these cavities and [slide] this is suggested barricading, of course with different design, in order to prevent trampling. [slide] Exposed roots should be covered with local soils. [slide] This was done at a few places. These roots have been protected by erecting wooden walkways. [slide] Here, as mentioned by Mr. Kannade, wooden platforms. [slide] There are few trees the cut-ends of which are exposed. From these cut-ends, decay and hollowness can enter, so we want to provide protection by painting them with eco-friendly materials.

[slide] At a few critical junctures, in some trees which are damaged to the roots, we propose that stones need to be removed. There are only a few. [slide] And at one juncture the wall threatens to collapse: if it does the tree will also fall. [slide] Then proper signage as previously mentioned, even beyond no entry signs people move.

[slide] This is the next stage we are taking up: regular monitoring, prescriptions and the capacity building aspect training at FRI, Dehradun (India) and the project site. For these two last points we require approval of the appropriate authorities to go ahead. Also for the treatments on selected trees we need the approval of the authority. Thank you."

#### **d. Drainage system within Ta Prohm temple, by Mr. V.K. Gupta, WAPCOS**

[OrigE] "Excellencies,  
Ladies and Gentlemen,

King Jayavarman created a beautiful temple, but I appreciate the architect who thought of it and created the underground drainage, and this underlines the importance of this drainage. [slide] Photographs of it have already been shown to you. With the passage of time, the drainage became blocked and the water started stagnating, up to a height of one metre, which badly damages the structure.

[slide] Another beautiful aspect which we want to maintain is that of the trees growing on the walls and in the building, which have become an important part of the building. In the case of a tree fall, the building falls, and vice versa. So we have to save them both to maintain the harmony between them. The heritage.

[slide] So we are faced with challenges. Creating storm water drainage is a complex feature. What is complex is the method selected to do it. The basic idea is to prevent further damage from flooding to both the structure and the tree roots which may be water logged. So we have to establish a technique of drainage and pipelines, while ensuring that minimum excavations should be undertaken to save the tree roots. Secondly, there must be no disturbance to the existing structure as any damage could create further damage to the structure. The width of the main gate does not allow large equipment to enter the temple complex. Due to the narrow gates of the 2nd & 3rd enclosures, drilling machines cannot enter these enclosures. These are the main challenges and under these challenges we have to work the proposal.

[slide] For this we have carried out GPR surveys, the details of which were shown earlier by my colleague Mr. Kannade. The surveys indicate that most of the tree roots are located at a shallow depth i.e. within a depth of 1m from the ground surface. Only a few roots have been found below this, and no roots were found deeper than 2m. So we propose to build drainage pipelines in such areas to be so designed that they do not disturb the roots. For this we propose that the drainage pipelines must be laid through trenchless technology.

[slide] Trenchless technology envisages 16 main lines connecting sinks to chambers and chambers to the inner moat. The complete network comprises of 29 sinks and 12 collection chambers located in the 2<sup>nd</sup> and 3<sup>rd</sup> enclosures. The diameter of the proposed pipes is of 300mm for larger links and 200mm for smaller links. Mild steel pipes with anti corrosive paint are to be used. The total length of drainage pipeline is 1160m, of which the length between Enclosures 2 & 3, with inner moat, is 760m and the length between the inner moat and the outer moat is 400m.

[slide] This is the plan which I would like to explain to you. This is the inner portion. S indicates sink and C is for chamber. The sink gets connected with the chamber and the chamber gets connected with the water. The water flows from here to here. We located the position of sinks in low-lying areas so that water can be drained from here to here. And this is the position of the machinery that we will be moving inside the moat. Except at four places where we have to place the machine to make a straight line from here and here. Otherwise all the machinery will be in the inner moat. From the inner moat to the outer moat, it will be from the same place.

Water comes out to the outer moat. From the outer moat we wish to connect it with the river system by a pipeline system. Weather permitting? We can connect the pipeline with the water and the water flows on. At the bottom it will be the overflow pipe water in case of heavy rain or flooding, water will overflow and will move from here to the river.

[slide] This is a sample of how we connect it. This is the location of the machine and this is sink number one, sink number two and this is the chamber. In fact this is to be connected here so we will be completing this process in two phases. First the machinery will be here, drilling a direct line connecting this pipe and then we will place it and connect it with the moat. Then we will place the machine here and connect it with this IC1 chamber. This is how the process will be done, by collecting the chambers and the sinks.

[slide] This is the machine which we feel is capable of doing the job. Small, so it can enter the enclosures and the gates. Dimensions have been given L = 246.38, B = 86.36, H = 121.92 cm, W = 1500Kg. It can be carted easily inside the temple complex to do the drilling job. This is an auger and with the machine the auger moves in. This is the methodology: the machine will be installed in the inner moat in a trench 3m x 1.25m x required depth +0.5m. In this case the moat is already deeper we will build a platform on which to place the machine and do the job. This process makes an auger of bore dimensions and the pipe for installation is attached with auger; excavated soil moves out of the pipe with the help of the auger. The pipe is installed in the requisite bore. The process is almost vibration-less. It has to be, otherwise it can damage the structure. The bore can be made up to the sink adjoining the structure. It does not require any pipes to be laid near the structure for the safety of the structure. Once pipes are laid, sinks and chambers will be constructed and steel pipes and alignment bores shall have to be straight. At a couple of locations with sinks at an angle, pipe installation is to be done by hand boring.

[slide] Components are pipelines used to connect sinks, chambers and moats using trenchless technology. Sinks enable surface water to enter the network and water from the sinks is drained into chambers and moats. Chambers collect water from sinks and provide easy movement of water even at an angle.

[slide] Around 30 Sinks will be provided at the selected low-lying areas. These sinks will allow only clear water to go into the pipeline below, trapping the silt, which will be collected in a trap and removed from time to time.

[slide] Chambers: water from the sinks will be collected into the chambers and drained out into inner moat through a pipe driven by trenchless technology. Minimum internal dimension of a chamber is 1x 0.5 x 2m; the number of chambers proposed: 12.

[slide] Keeping in view the available site conditions and constraints, the best trenchless technology is offered by the Horizontal Auger Boring (HAB) machine. In order to avoid the backflow of water from the inner moat to the pipelines, the inter-connection of the inner moat to the outer moat needs to be executed simultaneously. For the sustainability of the drainage system, a mild steel-pipe network with anti-corrosive paint has been proposed, which will not affect tree roots engulfing the pipes over the period of time.

For the efficiency and maintenance of the drainage system, sinks with geo-textile filters have been proposed, and the estimated time period of implementation is 9 months. Thank you."

Announcement from the Co-chairman for France: "the discussion which was planned now, as was the case for the Baphuon, is pushed back to this afternoon's discussion session after the experts' group report. I thank you and if we follow the agenda we should break for lunch offered by the Co-chairman. Enjoy your lunch".

Comment from the Co-chairman for Japan: "Ladies and Gentlemen we will resume our proceedings and due to a ceremony which was not mentioned this morning, we are starting 35 minutes late. So let's try to be efficient and catch up. One modification on the agenda, as you noticed some of the papers will include additional remarks from our *ad hoc* experts. We will then have a discussion once we have listened to their report. Following reports on Baphuon and Ta Prohm, we will now listen to Mr. Santoro for the western Bakan".

## **II.7 Safeguarding of Angkor Wat temple: Restoration work on the West Gopura and West Bakan, by Mr. Valter M. Santoro, I.Ge.S. (*Ingegneria Geotecnica e Structural snc*), Italy**

[OrigE] Excellencies,  
Ministers,  
Mr. Co-chairman,  
Colleagues, ladies and gentlemen,

I intend to present the project which is an effort of the Italian government regarding the conservation of some endangered parts of Angkor Wat temple. In 2004 the Italian government made a proposal after the project made with the Italian Funds in trust and UNESCO on some other areas of Angkor. The aim of the proposal was to use Italian expertise, mainly in the fields of structure, geotechnical hydraulic engineering, in order to preserve some of the endangered portions of this beautiful temple.

In order to keep a maximum utility to the city of Angkor, to the APSARA Authority, to UNESCO and also to the other teams working in different sites, the project concerns four different parts of the temple, mainly on the west of the temple. The west bakan tower, the main access to the tower, the west gopura, the cruciform terrace, the south-west gallery, part of the embankment of the west moat, and finally the northern half of the western steps.

[slide] Here we can see the four portions that were chosen by the Italians after visits on site. Each have typical features: structural problems related to geotechnics, features of instability of the foundation retaining the structure and hydraulic problems of interaction with the water table in the case of the moat.

[slide] The first item is Angkor Wat's West Gopura, the cruciform terrace which is the entrance to the main temple, seen immediately after the arrival from the main west causeway of the temple. The aims of the project are the restoration of the balustrades which are highly endangered and damaged with many loose parts and the strengthening of the columns of the gopura, the architraves and the walls. The protection of the stone surface of

the south face is also an objective. Some of these items such as the protecting of the stone surface will be carried out with other specialists working on site, such as the GACP team and the stone conservation unit of APSARA.

[slide] You can see that the west gopura cruciform terrace presents many problems related to conservation such as loose parts and damage to structures. Here you can see the balustrades that were restored in several campaigns by other teams in the past, with the reworking of original *colonettes* with concrete structures, the insertion of iron steel rods between the sandstone blocks, the insertion of cement and of several concrete parts.

[slide] Part of the intervention will be the removal of past activities which present chemical hazards for the protection of the original stone, such as the concrete cement, reprising the sandstone and the concrete *colonettes* with new sandstone *colonettes*.

[slide] The gopura presents issues of conservation of the columns not really related with the stressed state, as the latter is low because the vault is small compared with the cross sections of the columns, but the conservation problems are related to the genetics of the sandstone which presents several joints parallel to the axis of the column. The use of iron steel rods is required in order to reinforce the cross sections.

[slide] Studies were carried out in order to reconstitute the original geometry of the cruciform terrace as was identification of the damaged parts and structures. We made a proposal of reprising the concrete and cement portion and the steel rods with other stone fragments. The programme also recognised the presence of sculpted blocks all around the esplanade in order to recover them after small conservation and restoration. This was proposed to APSARA and other teams during recent visits.

Also the compression of the vault was proposed in order to complete the original structure by recovering the scattered blocks still available on the grass around the cruciform terrace, as was the replacement of missing blocks with new sandstone that should be carved according to original designs.

[slide] The columns will also be strengthened from a structural point of view in order to regain their bearing capacity. The last step is to protect the stone surface. This work will be done with the teams previously mentioned. The strengthening will be performed by insertion of fibre forcing elements that are totally hidden and are synthetic so that they are chemically compatible with the sandstone and will guarantee a confining pressure to the shaft of the columns in order to recover their lost bearing capacity. [slide] Here are some details of activities that will be carried out.

[slide] Now to the West Bakan pavilion, the second part of the project. Investigations on the retaining walls of the mountain temple structure: only a very few are available; reinforcement of the structures, strengthening of the columns and the walls, re-fixing loose blocks, setting up drainage in the massif, drainage of water stagnation on the floor of the lower parts, propping, and conservation of the southern face of the columns.

[slide] The Western Bakan is a long story because it was seriously damaged in the late 1980s and required, in the 1990s, urgent propping measures for the top structures because of the failure of some lintels, loosing some blocks. The propping was undertaken by APSARA, following a design made by the *ad hoc* experts at the time. But this propping is not allowing any entrance and closes the area for tourists. [slide] So you can see that the present day situation and the condition of the columns show important structural problems which require provisional belting with wooden planks and steel ropes to prevent further loss of materials. You can also see here the repairs that took place in the 50s, done with concrete and cement, and the loosing part of the top lintel, the front of the porch, and the failure of the blocks. A geometrical survey was made of all the staircases of the Bakan and reconstruction of the damaged parts was attempted. Investigations concern also the heavy damaged identified at the top of the porch. [slide] You can see, on the north elevation on the

upper part of the slide, failure of the lintel caused by the settlement of the downward columns.

[slide] This is the presentation of the strengthening proposal made for columns and in this case the contribution of a confining pressure made with fibre is required in order to recover the loss of bearing capacity. So why was there damage? This was investigated on site, and they showed us that behind the sandstone layer there is a laterite layer, and behind it sand fills. [slide] So we noticed a lot of loose blocks of laterite, mostly of sandstone due to some thrusting taking place behind this laterite wall. So we recognised, together with the *ad hoc* team that some actions could be caused by the roots of existing trees before clearing. These could have produced a great enlargement of the joints because of falling sandstone (for the most part) and laterite blocks.

There were also investigations to see if water seepage from rainfall could have also caused some thrust and other types of deformation to the staircase. [slide] So we carried out a sound and numerical analysis based on the results of our investigations, that showed the state of deformation due to the action of back pressure and this is the result of our simulation in terms of displacement, you can see the scales of response which is of a large magnitude. [slide] You can see how the back pressure in the soil behind the sandstone and the laterite retaining structure can cause this effect on the staircase and how it was harmed. This justifies the state of stress that is concentrated along the whole staircase. [slide] You can see the concentration of the stress on this model. And also you can see the concentration of stress for the downward columns which justifies the failure of the column themselves.

[slide] Following these results we have designed this drainage project that allows for less back pressure on the walls after seepages following heavy rainfall. The project will diminish the effect of the damage on the structure, and remove them. The retaining wall will be treated by applying normal techniques of rehabilitation of a retaining laterite structure. In this case the retaining structure is in sandstone.

[slide] Finally we have the southern gallery, the west half. We propose a monitoring system to control the extension of the state of damage which is very heavy. Investigation of the soils behind the downward gallery, analysis of the foundation pits and proposals for urgent measures will be undertaken. [slide] This is the southern part of the west half which you have already seen. This is the most neglected part of the gallery around the Angkor Wat temple. Unfortunately this one was less attended to by the different campaigns of restoration, even though the level of damage is very heavy as you can see from this inclination, tilting the cracks of the counter beam. [slide] This survey made by APSARA in the late 1990s shows a very high differential settlement. We will carry out a geometrical survey and analysis of the structures across the section. These analyses are based on a monitoring system that we have had on site since 2003. We are basing our analyses on crack meters and inclinometers that show this kind of trend. [slide] We have a cyclic variation of opening of the cracks that is related not only to the temple but also to the evaluation of the water table, here the purple line. This information was provided by JASA. This means in this case that the action of water pressure seeping in behind the retaining structure can cause the tilting of the retaining structure and the opening of the cracks of the above counter beam. In this case there is a correlation between the supporting structure and the causes we have identified with the action of the water

The last part of the project is related to the restoration of Angkor Wat's western moat embankment, and the northern half of the west steps. [slide] Here are presented the different scopes of the project: a topographical survey is provided, detecting the blocks of the staircase and investigation of the mechanical problems of the backfill rehabilitation over a 30m long span of the embankment. This is the situation: we have carried out a detailed survey and established a catalogue of the sandstone and laterite blocks in order to remove them, to restore them and to place them back in their original sites. [slide] This is the survey of the identification, stone by stone, of the old sandstone and laterite quarantine. This is a cross section reconstructed by geometrical survey. [slide] This is a numerical analysis made in this



case in order to identify the water back pressure fills that caused the collapse of the staircase as was the case in the other project we carried out in 2003.

[slide] This is the cross section we propose to reinforce with geotextile and to install back drainage in order to reduce the temporary back pressure that caused the collapse of the embankment. [slide] This is the plan of the project we are proposing. [slide] This is the other cross section with the drainage. [slide] This is the old state of the east steps of the southern half of the embankment after collapse in 1997. [slide] This is a comparison with the present condition following our intervention in 2002-2003 presenting the final result of our intervention. Thank you very much."

Comment from the Co-chairman for Japan: "thank you Mr. Santoro, as previously said, questions on the Italian project will be asked after the experts' report. I would also like to modify today's agenda. I propose to move the break planned after the experts' group report to later and to take that break after listening to the papers on stone conservation. So after the presentation of the Sophia University we will take a break and then we will start with stone conservation items. Do you agree? [No objections from the audience]. Ok, let's proceed."

## **II.8 Presentation by CSA (Chinese Safeguarding Team for Angkor)**

### **Introduction by Mr HOU Weidong:**

[OrigE] "Honourable Deputy Prime Minister,  
Honourable Co-chairmen, Excellencies,  
Ladies and Gentlemen,

Good afternoon, we are from the Chinese Academy of Cultural Heritage (CACH) and we are proud to have such an opportunity to attend the ICC meeting and share the new achievements regarding the development of the safeguarding of Angkor with so many friends. Our presentation will discuss the preliminary results on the architectural study of Ta Keo temple and the conservation and restoration strategies.

We actually started the Ta Keo project at the end of 2007. In case you are interested in our project, you are welcome to contact us at the CSA and I hope that we will communicate and exchange viewpoints on interesting issues. Two persons will present: the first is Dr Hou and his presentation is on the architectural history and restoration study of Ta Keo."

### **a. General Conservation Strategies for Takeo temple, by Prof. HOU Weidong, Director-General of Takeo Project, deputy-director of CACH (Chinese Academy of Cultural Heritage)**

[OrigE] "Honourable Co-chairmen,  
Excellencies  
Ladies and gentlemen,

My presentation is on the architectural study and restoration of Ta Keo. [slide] The contents include four parts. Acknowledgements: APSARA Authority, EFEO, JASA. [slide] Background: the investigation survey and the documentation mission for the second phase of the project of the Chinese government team for safeguarding Angkor programme were implemented from December 2007 until December 2008 by CSA in cooperation with Tian Jing University. Subsequently the same staff began to carry out architectural and restora-

tion studies as well as conceptual reconstruction of Ta Keo, so as to offer guidance for the conservation project a technical analysis was needed.

[slide] Ta keo is a typical example of the architectural principles of a temple mountain and its characteristics. [slide] Ta Keo's status is high. The architectural evolution of the temple played a critical role in offering carving details of Ta Keo. The cultural and religious symbolisms for Ta Keo are a reflection of Buddhism and the local culture.

In brief, Ta Keo represents a spectre of architecture, socio-politics, religion and symbolism. [slide] Our project is sourced from two parts. The first part is the work; the second is the review. The staff has searched the larger part of the documentation from sources coming from the Conservation of Angkor and the EFEO: inscriptions, photographic recordings and many drawings which have been published.

[slide] The architectural style: the first part is the name of the temple; the second part is a brief history of Ta Keo. Jayavarman V and Suyavarman I were the most important kings.

[slide] Conceptual restoration includes the current excavation of Ta Keo, assessment of the site and its surroundings, the monument, and an architectural analysis.

[slide] Temple mountain architecture, details of plan: first floor, second floor of the pyramid, the *prasat*, tower, and the gopura.

[slide] Another part is the historical and social analysis, hydraulic system and symbolism. [slide] Our restoration concept includes the site and its surrounding, the *prasat*, gopura, long hall, gallery, library and decoration.

[slide] Conceptual restoration of the site and its surrounding areas. The relationship between Ta Keo and the Eastern Baray. [slide] The construction site plan for Ta Keo. [slide] The sections and elevations under reconstruction. [slide] Section and elevation of the current condition of Ta Keo. [slide] The *prasat*: the central and four corner towers. [slide] The research process. [slide] Analysis, laser scanning and point cloud data. [slide] This is the current *prasat* restoration. [slide] The restoration of pediments. [slide] Reconstruction of the central *prasat*. [slide] Corner *prasat*.

[slide] The next project is the gopura. There are eight gopura at Ta Keo of four types. [slide] Elevation. [slide] Analysis. [slide] One type of gopura, [slide] another type, [slide] one more and [slide] the last type of gopura.

[slide] Long hall, [slide] reconstruction model, [slide] reconstruction analysis, [slide] elevation analysis, [slide] produced analyses.

[slide] Libraries: Ta Keo has two library north and south. [slide] Construction and analysis of library, [slide] elevation, section and plan; [slide] gallery, [slide] gallery section and elevation.

[slide] Corner tower: Ta Keo has four corner towers located at the corners of the galleries. [slide] Analysis, [slide] elevation.

[slide] The last conceptual restoration is on decoration and ornaments. [slide] Analysis of the pediments. [slide] Reconstruction of the pediments. [slide] Model of pattern of reconstruction. [slide] As Ta Keo does not have any decoration of its lintels, we have carried out studies of the decoration.

[slide] Bibliography used. Thank you for your attention."

**b. Results of preliminary architectural research for restoration of Takeo temple, by Dr. Wen Yuqing, CACH & CSA (Chinese Team for Safeguarding Angkor)**

[OrigE] “You have been presented the work on the study of the restoration of Ta Keo, which we think is valuable because it could be very helpful to the conservation work. As Mr. Hou has presented restoration of Ta Keo, I will focus on conservation. My presentation will be divided into four parts: Prefixes, site survey and investigation of Ta Keo, primitive research and study, main concepts on conservation and preservation. As we have heard, Ta Keo is undergoing its second phase of the project and this will be the continuation of collaboration between Cambodia and China.

[slide] Chapter two: site survey and investigation in Ta Keo. The survey was of three kinds. One: survey and measurements on site; two: geo technical engineering investigation of the site; three: technical investigation of the site.

[slide] The survey and measurements included laser scanning and manual measurements to record the information of the present situation of the monument. For 3D laser scanning survey, we did a general layout of Ta Keo and a survey and mapping of the surroundings. [slide] Second: the surveying and measuring of the mountain temple of Ta Keo. [slide] Third: a surveying of the recording of the scattered stones.

[slide] In this picture you can see Ta Keo and its surroundings after scanning. We used a machine to carry out the laser scanning of all of Ta Keo. [slide] In this picture you can see where the stones were scattered in green. This will be useful when we start to research what was demolished in the building. After scanning we carried out a treatment of the recording and drawings. It included data registration and from this we go to the completed point cloud using surface and geometric models. We also use photograph and 2D line drawings which would be very useful for measured drawings, semantic research, design drawings etc. As for the geometric model it could be used for presentation rendering and so on.

[slide] So there are six types of resulted images for 3D laser scanning. It includes 3D point cloud model, 2D photo point cloud model and 2D sleeves profile, the horizontal vertical hatching line graph, 2D image map and 3D image map. It means the scanning drawings are incorporated with digital pictures. Maybe this is not an exact explanation.

[slide] From this programme you can see that from the scanning we created a 3D model. This is the primitive scanning result, then we produced the model. We also produced line drawings. This is a combination of the line drawings and the pictures.

[slide] The second part of the investigation is managing the information of the drawing. As we have to carry out the conservation work, we have to show all the problems of the structures and the materials with special marks, and show the positions. There is much information: partial demolition, cracks and gaps on the wall, sinking of the wall or foundation, displacement of the structure, inclination of the structure, stone breaks and loss of stones. [slide] We used the scan records of the drawings of the site to record all the problems.

[slide] There were eight parts that we chose for the making of detailed drawings. They include the east and west gopura of the first floor, the south gopura of the second floor, the four base corners on the second floor and the east long galleries and the south gallery on the first floor. We selected these areas because they were at risk.

[slide] From the drawings we showed all the problems. We used colours and symbols to show the problems of the building. [slide] For example, this colour represents a special kind of material. In red are the cracks. [slide] We also mapped all the problems. [slide] This is a dan-

gerous part which was supported by a wooden frame and which would have collapsed without this support.

[slide] Geotechnical engineering investigations of the site include: geotechnical investigation and surveys of the working site and a foundation and infrastructure survey of Ta Keo. This includes engineering in different fields. [slide] This picture shows the location and the type of work of geotechnical engineering investigations, some borings, and water test boring. [slide] This is the working site. [slide] This is the technical machine used for the prospective. [slide] We also did a primitive investigation on the decay of the stone on site. We collected some samples such as stone fragments, rock powder, etc.

[slide] Chapter III: primitive research and study. We carried out five types of research. First: basic situation of the environmental background; second: the present situation of the temple mountain; three: analysis and calculation of the foundation; four: structural analysis of the southwest corner tower; five: the main problems of Ta Keo.

[slide] We think that there is a good environment and a good master plan of Angkor. There are no natural disasters and transportation is easy and management by APSARA and the distribution situation promote prime activities.

[slide] The damage of the building: we carried out an investigation of the whole building. This is a study of the first base. The situation was better than at the second base except for some corners, which are demolished. [slide] The second base is severely damaged and needs conservation work. [slide] All gopuras have problems with parts collapsed, sinking and cracks. [slide] The lintel collapsed. [slide] The two libraries have problems which are only partial and are not major structural issues. This is a picture of a corridor which is partially demolished. The *prasat* condition on the top base compares favourably with the corners and gopuras.

[slide] Three: analysis and calculation of the foundation. This time we used a programme to calculate the situation of the foundation. [slide] This is an integrated general model. We calculated the load as equivalent and [slide] this shows the displacement of the foundation on the gravity field. This is a portion of the seepage field. [slide] Herewith the vertical displacement and the coupling effect of the gravity field and seepage field. [slide] We also calculated some corners in danger. [slide] This is the first layer of the corner with the displacement showed. It has been assumed that the damaged areas on the corner are contemporary. [slide] We used another programme, a GTS, to calculate the model. This is the top terrace of Ta Keo.

[slide] Four: structural analysis of the southwest corner tower. We built this model using each stone block. Each piece of stone was used to build this model, instead of using the complete structure. So we think this is rare. [slide] From this calculation we located dangerous areas, such as this one for example. [slide] Here is another type of calculation.

[slide] Following our studies on Ta Keo we think that the main problems are: one, uneven distribution of the stress and seepages which caused the infrastructure to subside and the drainage of the base layers are generally difficult. Two: parts of the structure are unstable; because of the subsidence of the base, some structures collapse easily. Three: the decay of the stone surface of sculptures.

#### Chapter four: Main concepts of conservation and presentation of Ta Keo:

- to maintain the authenticity of the site,
- to avoid any hazards or demolition, hi-tech [materials] can be used if required
- Any new materials used should be [set] after test.
- Any new physical consolidation should be reversible.
- The blocks that fell could be reset to their original position,
- Any new restorations are normally forbidden.

This is the regulation we should follow for our restoration work. <sup>[slide]</sup> There is an ideal time schedule. Over the next five years, we plan to repair dangerous areas and to install a new drainage system and conserve the sculpture and stone surface. For the medium term plan, maybe for the next ten years, we wish to repair the damaged parts of the corner of the base and improve the environment, among other activities. Thank you."

Comment from the Co-Cairman for Japan: "as planned we can start the question and answer session regarding the Chinese team's project. Are there any questions or remarks? Mr. Beschaouch you have the floor".

Comment from Mr. Azedine Beschaouch: "firstly, I think that all my colleagues would agree with me to express their satisfaction in seeing among us the Republic of China's team, which year by year is getting reinforcement: this year with the arrival of the Chinese Academy for Cultural Heritage. This can only increase the technical potential of our Chinese colleagues. We are also satisfied that, after what was recommended for many years, prior to any intervention detailed and multidisciplinary studies are carried out, which is reassuring us. I would like to ask a question to my colleague. What do you mean when using the words 'any new restorations are forbidden': which meaning do you give to the words 'new restorations'? [Question to] Mr. Hou Weidong or Dr. Wen Yuqing; because the words 'new restorations' whichever language you use, are difficult to understand. So what do they mean for you?"

Answer from Mr HOU Weidong: <sup>[OrigE]</sup> "the word restoration means, for example: in Ta Keo the roof had collapsed and we didn't want to rebuild the roof. If the materials collapsed we put them back in their original location. We don't think this is restoration. For me, restoration means new structures replacing those which have disappeared. Thank you."

Comment from Mr. Azedine Beschaouch: "thank you very much, I now start to understand that you were mentioning new structures, that's fine".

## **II.9 Report from the ad hoc Group of Experts for Conservation, by Professors Mounir Bouchenaki, Giorgio Croci, Pierre-André LABLAUDE**

Introduction by Mr. Beschaouch: "on the agenda four Professors are mentioned: Mounir Bouchenaki (ICROM), Giorgio Croci (ICOMOS), Pierre-André Lablaude (France), Hiroyuki Suzuki (Japan). As you have seen, Professor Suzuki could not join us as he has retired from the University and told us that he wishes to be replaced. His own words are that 'when I was working for the University my participation was justified'. I must admit that he shows extreme intellectual honesty, as his expertise goes beyond the University. But before my colleagues present, I think that the secretariat should pay tribute to Professor Suzuki, as he collaborated with us for a decade. For the past ten years his actions have strengthened the technical knowledge, professionalism and neutrality of our group of experts. He was always very smooth with and friendly towards his colleagues. And I would also add that he was very humorous. He also had a great asset which is that when he did not understand something, he would say: 'I do not know so I cannot judge' and this is rather exceptional in the world of experts and should be stressed.

We wish him a peaceful retirement. We know that in Japan he is allowed to offer his services for what in France, Italy and Europe in general is called Open University. But still we strongly regret that we will not, on a professional level, be able to benefit from his expertise, and on a personal level—although we remain friends from afar—that we can no longer enjoy his presence for two weeks a year. So I would like to propose, with the approval of the Co-chairmen that, we, the secretariat send him a letter to testify of our friendship and to tell him that his departure is deeply regretted. On the bright side, he retires with full physical and intellectual ability; he does not retire because of any disease but again because the man is very demanding with himself, an intellectual demand. So if you

agree we will send him a letter and I think that in the forthcoming years—let's hope that God will extend his lifetime and fitness—we will certainly require his services and expertise or when we ask for advice on some difficult issues he can share with the experts his point of view. That's all I wanted to say.

So the tasks were divided into three and not four. The procedure is the following: The experts visit the sites and in a neutral and independent manner examine the problems raised, debate among themselves and then meet with the secretariat. We note down their observations, and an expert always speaks on behalf of the *ad hoc* expert group. You will listen to three reports. These three reports are not Bouchenaki, Croci or Lablaude but are the three of them expressed by one voice. If you allow them to they will start. Thank you"

*The Co-chairman for Japan:* "Thank you Mr. Beschaouch. Of course the Co-chairmen join in with the tribute that you paid to Professor Suzuki. Now the experts have the floor, starting with Mr. Lablaude".

### **Mr Pierre André Lablaude:**

"The site visit reports were allocated among experts, and I will mention those concerning Angkor Wat and the Phnom Bakheng.

The *ad hoc* expert group went to the site, accompanied by Professor Walter Santoro, to examine the project of the Italian team in the Angkor Wat temple.

The project concerns several buildings presenting severe structural damages, which magnitude and visibility are a sensitive issue, as they are located on the most frequented circuit used by visitors from the main east-west axis of the building. We will go from west to east.

The proposed intervention on the northern half of the western embankments of the moat is exactly symmetrical to the previous intervention also carried out by the Italian team on the eastern embankment of the moat. It will follow the same technical procedures and is completely approved by the expert group, as are the works on the cruciform terrace, which present appearance, such as structures or recent restoration with cement, is not satisfactory. While we approve of these works which concern the aesthetic of the building, we also recommended the seizing of this opportunity to search the stone storage area of the site or the Angkor Conservancy in order to check the possible presence of fragments or pieces of naga which could come from this construction and could be put back *in situ*.

The reinforcement works of the structure planned for the western entrance's gopura and for the western pavilion of the Bakan present similar problems. The *ad hoc* expert group approves entirely the proposal of the Italian team to conserve all the ancient materials, especially knowing that some of these elements, in particular the pillars, present several inscriptions engraved in Chinese or in French. These are rare and precious testimonies of the 'rediscovery' of Angkor by foreign travellers in the late 19<sup>th</sup> century and early 20<sup>th</sup>. The experts also approve the technical method proposed to be used for the strengthening of faulty structures, by installing a drilled and invisible reinforcement system. Nevertheless, due to the advanced state of decay of some of the stone blocks, the experts mentioned the necessity to associate with the structural engineering expertise—which is the team in charge of the project core expertise—a restorer specialising in stone. The latter is missing and his presence will allow us to better work simultaneously on the reinforcement of the material on the one hand and of the structure on the other.

Regarding the questions raised on the stability of the stairs and of the supporting massif of the western pavilion of the Bakan. The experts were able to:

- study the first stability reports carried out on this structure;
- observe the installation of the measuring tools in order to monitor any potential movements;
- validate the proposition of Mr. Santoro to set up a drainage system in the inner back-fill, in order to prevent any likely pressure from water seepages.

The experts recommended not rebuilding with new stones the missing parts of the string walls on both sides of the central stairs and to restrict reconstruction to the possible reassembly of ancient components coming from this structure that might be located/found in the stone storage areas located in the peripheral courtyards of the central massif.

The experts would like to draw the attention of the ICC Co-chairmen and the High-officials of the APSARA Authority to the urgent need to provide official administrative authorisations so that works can start on site concretely.

The *ad hoc* experts' group also considers that the implementation of these works shall be the opportunity to reassess the present conditions, which are actually rather illogical, of the visit of the central section of the temple, knowing that:

- in the first instance, beautiful and costly wooden stairs were built to allow safe access for the visitors to the upper section of the temple.
- once the construction was completed, this section was closed using safety as a pretext.

The experts think that we cannot deprive any longer national and international visitors from enjoying the unique aesthetic qualities of this masterpiece of world architecture, so that they can feel the symbolic and spiritual dimension of it. After Angkor Wat we also visited Phnom Bakheng.

The presentation on that temple was done earlier. Let's first recall that in the early 1990s and following a first survey of the condition of the temple, it was identified as presenting major risks in terms of monument conservation. We can therefore only express our delight to the commitment taken for the safeguarding of this building by the World Monuments Fund team, which was restructured around Mrs. Konstanze Von Zur Mühlen and Mr. Glenn Boonazian, including some international and Cambodian experts.

The difficulty presented by this project is firstly due to the elevation of the site, which is on top of a rocky hill. Structural damages aplenty are in constant evolution and these are scattered all over the site, as shown by the risk map drawn by the project team. These specifications led the team to define an organisation and strategy based on installing and moving in several areas a gantry crane. This could allow for more efficiency and rapid intervention, focusing first on the eastern third of the temple.

The site visit and the series of 60 small sanctuaries reacquainted us with the traditional debate, a ritual now, between experts in Angkor on the technical, aesthetical and even philosophical comparative merits of two different, if not antagonistic, approaches:

- on the one hand using the dismantling-reassembly technique,
- on the other hand *in situ* consolidation of the damaged structures.

This debate is technical and aesthetic but also philosophical and ethical, and found on all sites. On this issue, the *ad hoc* expert group recommends the taking of a measured approach, by exploiting as much as possible the potential and efficiency brought by the gantry crane for the dismantling and reassembly works, and executing them easily and rapidly. But this technique shall only be used in cases when the scope of the damage is such that they will not allow for *in situ* consolidation.

The *ad hoc* expert group was able to express its concerns regarding the conservation of the peripheral brick towers which suffer from an obvious rapid decay, and which recent

archaeological investigations, carried out by Cambodian archaeologists of the WMF team, have proved the major historical and scientific values.

Although the restoration programme, as of now, favours works on the sandstone structures, the experts ask the WMF representatives to dedicate a chunk of their budget to the implementation of temporary measures to:

- ensure on the one hand the boxing up of some of these towers by setting up a temporary light roofing;
- on the other hand, the guaranteeing, by installing additional propping, of the stability of some structures highly at risk.

It might also be a good idea to set up on one of the towers, maybe the G.10 that we visited together, a small experimental workshop to strengthen and partly reassemble this type of structure. This could help to better identify, for the future, the stakes in terms of feasibility and costs for implementation. Thank you for your attention."

**Mr. Mounir Bouchenaki:**

"Honourable Deputy Prime Minister,  
Honourable Co-chairmen,

It is always a delight to be among my colleagues, Professor Croci and Mr. Pierre André Lablaude, in visiting the sites and reporting on what we saw. The first half of the report was drafted by two of us only, as we arrived on the evening of May 28. Invited by Mr. Seung Kong, we visited the following sites:

- BÊNG MEALEA,
- PRASAT CHREY,
- PRASAT KONG PHLUK,
- SPEAN KHMENG,
- SPEAN KOMPOMG KDEI

I wish then to report on behalf of Professor Croci and myself on this visit of the above sites. We were accompanied by Cambodian students from the Royal College of Fine Arts of Phnom Penh.

1. The group of experts had already had the opportunity to visit the Beng Mealea site and to draft a report to the committee on this site. It is considered as one of the most spectacular sites of the Angkor region, engulfed by vegetation as it is. The workers team of the APSARA supervised by Mr. Seung Kong have completed substantial development works. Some Naga sculpture fragments were redressed along the western causeway and regular maintenance, which we saw on site, is carried out; this to facilitate the temple visit.

Two issues on this matter: the fragments of sculpture which have collapsed and lay near the visitors' circuit, and the issue of the extremely dense vegetation which in some areas represent a threat for the stability of the monument.

I was delighted to see that, earlier, and for the first time presented by the Indian team, was a detailed and interesting report on the management of the vegetal canopy; this could be applied to Beng Mealea.

Regarding the first issue, we proposed to continue clearing fragments of sculpture laying in the backfills and to proceed to reinstate them when their location is known, under the supervision of an archaeologist in case the clearing might concern archaeological levels.



As for the second matter, we have to face the complexity of the vegetal canopy, which can act as protection for the built-up areas and especially in preventing stone decay, but is also a threat to the structures. We proposed to draft the overall plan of the site identifying the areas presenting immediate danger and committing the students of the Fine Arts faculty for the measured drawings, photos and suggestions for clearing the vegetation on clearly defined areas. During the next ICC session, a workshop on site could be organised to bring interaction, and the youths working in the field could start integrating the teams of workers. As for the experts, they will be there to give advice and recommendations on the strengthening and reinstatement of the structures.

2. At Prasat Chrey, a few kilometres to the south-east of Beng Mealea, the APSARA team cleared an access path to the temple. The south-east gate of the temple might collapse due to a dual deformation caused by the thrust of a tree and by damage in the base which has already led to the fall of a lintel.
3. The APSARA team is clearing Khong Phluk temple and the small temple located to the east of Beng Mealea. These temples once cleared of small bushes and thin vegetal canopy will certainly be an additional attraction for visitors to the Beng Mealea area.
4. We also saw two ancient bridges: the first in Spean Khmeng on the Chikreng River, where it is recommended to start consolidation works immediately. This bridge is prohibited to vehicles heavier than 3t, but its present condition might not resist any kind of traffic, even lighter vehicles. A bypass will be built and traffic prohibited during the necessary consolidation works. The services of the governor of the province might be called upon in order to build a bypass road. The second bridge, Spean Kampong Kdei, is in a very good condition. No traffic is allowed on the bridge although perhaps light vehicles could use it.

This was our first day on May 29, and I would like to thank again the team of Mr. Seung Kong which made itself available for the whole day to present the details of this highly interesting area. An area of interest for our sustainable development colleagues, as it might help better organise the tourism flow in the Angkor region. Mr. Pascal Royère then welcomed us.

Works carried out on the Baphuon have already been presented several times and today Mr. Royère presented the full extent of the works in progress. Noticeable also was the consecration of the reclining Buddha by His Majesty King Norodom Sihamoni, with high officials of the Government attending. This confirmed progress made in the restoration works since they restarted in 1995.

Mr. Pascal Royère presented the latest developments of the temple he is in charge of, and explained the choices made, especially regarding the technical possibilities of anastylosis and in particular the rehabilitation of corner structures. The scheme selected aims at letting visitors have the potential to understand the use of materials, leaving full visibility of the laterite blocks without finishing the corner structures with damaged sand stone. This scheme was subject to a long debate between the experts and Mr. Royère. We understand the background of the chosen scheme which is perfectly valid on a scientific level, nevertheless regarding the missing parts the experts reiterated that the visitors might not understand the rationale behind what could be seen as an unfinished restoration. The debate is still going on, so that a solution may be found between the quest towards scientific truth and the rehabilitation of what is existing and its showcase to non-informed visitors. Recommendation was then made to re-study this matter, in particular for the most visible areas, as I don't think there was any necessity to re-assess the whole site.

Another recommendation was to implement the same careful proceedings in the restoration works for the upper sections of the Baphuon and to treat them as comprehensively as possible, as was done for the rest of the temple. Due to the interest and symbolic value

of the monument which is the mythical representation of Mount Meru, it seems obvious that visitors will want to access the highest level of the temple. The outstanding work carried out by the EFEO architects, and since 1993 by Mr. Pascal Royère, has facilitated the legibility of the monument in all its different stages through history. The dressing of the stone and especially in the areas with missing parts, and the rehabilitation of laterite blocks on the wall set back from the reclining Buddha have been praised and considered as a success in terms of presenting the volume of the temple.

The experts are satisfied with the cooperation established between the research and conservation teams of the Angkor site, in particular at the Baphuon, and acknowledge the importance of this cooperation. The example of the work carried out by Professor Hans Leisen's team on the conservation of bas-reliefs in the Baphuon shall be followed up and strengthened.

I will now finish by reporting on the visit we made to the Bayon.

The Japan-APSARA Safeguarding Angkor team (JASA), supervised by Professor Take-shi Nakagawa, presented to the group of experts restoration works carried out in the temple and in particular the dismantling and reassembly of the southern library, as well as the study on the inner structure, the drawing of the risk map and the outcomes of investigations of the deeper levels of the central tower.

The group of experts was extremely satisfied with the quality of the presentations held by young Cambodian professionals (one of them enrolled at ICCROM). Along with a very accurate documentation, they talked about the different phases of the project: dismantling of the main structure, analysis of the deformation, archaeological research works on the central section and discovery of laterite architectural elements, etc. During dismantlement of the library, several tests and trial excavations were carried out in the central section of the library. They exposed the few items that were shown here this morning.

A database on sandstone conservation and the reinforcement of laterite blocks was created. The experts consider this work to be extremely useful for whole of the existing restoration sites. The treatment of the blocks, as much during dismantlement as during reassembly, shows that the systematic analysis of the construction mode and the proposals to treat the missing parts are well mastered.

I would like, on behalf of the group of experts, to answer a question asked by the archaeologist who presented to us the square laterite walls found for the first time in the central part. These walls, according to the experts, might have been used for load distribution to reduce the thrust on the outer walls of the structure: unless, as an archaeologist would think, they belong to previous structures, but only an archaeological excavation could determine this. I do not think that this is the most likely answer; we would rather propose to the team of Professor Nakagawa that these walls were used for load distribution. We were also briefed on studies carried out on the central section. The geotechnical analyses have confirmed data obtained by the different research carried out by the different teams of Professor Nakagawa. We were then also informed of the stone decay level and of the proposals to age the stone on site, which will be assessed year by year in order to evaluate which type of constituents should be used for sandstone restoration.

Moreover, a systematic analysis of the risk zones extended to the whole of the Bayon, and the deep test-pits carried out in the shaft and on the western platform of tower number 6 helped to better understand the composition and strength of the ground levels supporting the central structure of the Bayon.

The experts think that this type of very useful analysis shall continue, in order to reinforce knowledge on the dimensions of the inner structure of the tower in order to be aware of the full scope of the issues concerning stability. The group of experts considers that the detailed analyses carried out by JASA enabled the production of a true risk map of the

monument and should lead to a synthesis overview of the materials, the building methods, their evolution and the rehabilitation process.

The experts congratulate JASA for having associated professionals working for APSARA at all stages of the project and thereby having contributed to the scientific and technical training of local expertise, the real objective of the international cooperation, as recommended by UNESCO and ICCROM. Thank you for your attention”.

**Mr. Georgio Croci:**

[OrigE] “Excellencies,  
Mr. Chairman,  
Ladies and gentlemen,

I prefer to speak in English as my report concerns the Indian and Chinese teams, so it will be easier for us to understand each other. I also prefer not to follow the written report but to speak freely. I will start with Ta Prohm.

We have to remember what happened at the beginning. At Ta Prohm, even before the arrival of the Indian team, it was not clear what should be done. At these ruins, where we have this fantastic growth of trees, we had the idea of a kind of romantic site but at the same time some ruins that could not be recognised. So we said maybe it would be good to restore and make safe some parts, and to create some parts for tourists. So when the Indians started the work, I have to confess that the instructions given by the experts were not clear for us.

So we started to learn, together what to do. I remember the first year there were misunderstandings and the cohesion was not perfect. I want to say that I am very happy after what I saw in previous days, and I think that a balanced restoration has been achieved. We have seen wonderful restoration of the gallery, the third enclosure of the south wing, and also excavation, with the discovery of the ancient drainage system, which will remain visible for the tourists. That is something that did not exist before as there were just blocks on the ground and it was impossible to guess what was under them. That is an example of good restoration work. There were problems with some galleries where it was difficult to tell tourists not to enter. So the design of a light steel propping, indispensable for safety, was done, and it now allows people to enter.

Approaching the Hall of Dancers the situation on the ground was difficult and it was hard to walk. Also, little bridges and platforms were built to facilitate the visit. And when you end the visit there is another platform and a terrace for looking at the structure. Two problems were faced, and the proposal concerning drainage is interesting and clear. There are sinks and chambers running off water to the moat and then to the river with the help of pipes which can be drilled horizontally with special equipment. So I think it is a good solution to the problem of water. Because we have to remember that there and in most temples, problems come from the ground and water. So, solving the problem of water or at least reducing flooding and improving the situation will improve stability.

And finally the presence of the first Forest Institute is essential. I appreciated the competence of the speaker, as I was one of the few who said ten years ago that trees have to be respected and not cut, as they are a part of culture and natural heritage. And now to see all this care taken for the trees is a demonstration of the attention given and the benefit that will be coming from the training of this institute to the APSARA Authority and maybe to other teams in a similar situation. So I would like to thank the Indian team for this excellent result.

As for Ta Keo, the Chinese team is at the beginning and has already carried out excellent preliminary work which is synthesized in two documents.

The first document concerns the methodologies and the plan of investigation that will be used for the geometrical survey, the damage survey, the geotechnical investigation and survey, the surface survey, and mathematical model and the methodology that the team intends to follow in the phase of maintenance and intervention. I think it is a very detailed, scientific and precise approach.

The second report, I think, is excellent, although I don't want to use that word too much. It is useful not only for the studies of Ta Keo, but also for all the temples at Angkor, showing the history and development of the main elements which constitute a mountain temple, as seen in the *prasats*, gopuras, galleries and libraries. This is the first time that I have seen such complete documentation with photographs and researches. So I think it is very useful for the restoration project.

Now that we are at crossroads, what to do? There is a need to develop the diagnosis phase. To have a lot of results or investigations does not mean you understand the causes. It is the indispensable base to understand the cause of damage, decay and the reasons for them. And I think that this is the phase which requires a lot of experience and is very important because that is how you make the correct restoration project. During the visit we spoke mainly about two kinds of problems. One is the corners which are decayed, present detachments and are partially collapsed. Probably the cause is related to the pressure of the soil or in some cases possibly the roots of the trees. Because corners are weak points, due to insufficient overlapping of the stone so they are not well connected on the corners. Due to the pressure the corners open. The focus on the restoration project should be to create a good overlap besides finding ways to reduce the water pressure on the soil. Finally and as was presented, some gopuras have large deformations that can be related to soil issues but most likely to the decay of the stone at the bases due to the change of the level of the rising damp and rain, which accelerate the decay and could easily create lateral deformation and damage.

To conclude, bear in mind that to dismantle and rebuild is not the sole option, anastylis is not the only option. In case of lighter damage, one should look at the possibility of stabilising the situation, maybe using jacks to recover the deformation; this was done several times, to go back to the original position, and also to use some chains and connections. The result is not as good as when it was brand new, but traces of history are also important so I think a discussion could be held on a case by case basis in this regard. Thank you very much."

*Comment from Mr. Bouchenaki:* <sup>[OrigE]</sup> "I would like to add something to the discussion on Ta Prohm and following the visit and the proposal on drainage by our ASI colleague. We discussed the necessity of having an archaeologist present when digging the chamber and various places as you may probably find some artefacts or levels that could be registered for the history of the site and I want to add this because we discussed it with our colleague but I wanted it to be on record for the recommendation. Also for Beng Mealea, the fact that a number of artefacts have been unearthed raises the problem of conservation. Here again we must always link archaeological discovery and the conservation of objects and especially stone conservation. Thank you."

*Contribution from Mr. Beschaouch:* "Messrs Co-chairmen, I would ask not to modify the agenda but to add something to it. We are used to, during our committee, presenting international examples to illustrate that this committee is not only for Angkor but that it is within a world-wide perspective. The fact is that last year UNESCO carried out a remarkable task. Financed by the Italian government, it was still under the responsibility of UNESCO. I am talking about the return of the obelisk of Axum, which left Ethiopia and went to Italy and was subsequently returned. Mr. Koitso Matsudara considered that it was the duty of UNESCO to be in charge of the operation. So if you allow us, as it was one of our experts which was in charge of the expertise of the operation, would you give him a couple of minutes so that with a few pictures he may present the operation and that we display the solidarity of the World Heritage".

Comment from the Co-chairman for Japan: "on principle I agree to modify the agenda but as we have already skipped discussions on the Baphuon, Angkor Wat and Ta Prohm, I would rather open the discussion before presenting this operation. So I would like to invite observations or questions on the three papers presented before we proceed in presenting this operation which seems highly of interest. So please start questioning on the presentations on Baphuon, Ta Prohm, Angkor Wat or make observations on the group of experts report".

## GENERAL DISCUSSION

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Question from Mr. Pierre Grard: <sup>[OrigE]</sup> "I will also speak in English to facilitate communication with my Indian colleagues. I would like to say that I have been very impressed by the work which has been done because the last time I was at Ta Prohm was two years ago. I have a question for my colleague from FRI. I wonder if it would be interesting to install belts around the bark to survey the growth of the trees and to link the growth of the trees with the sensors that will be used to survey the movement of the stone, and beyond that to try to set up an early warning system to warn when a tree is moving inside the diameter of the bars."

Answer from Mr. V.K. Gupta: <sup>[OrigE]</sup> "regarding putting sensors to measure the growth of the trees this can be done. Belts? You want to put them across the branches of the roots?"

Reply from Mr. Pierre Grard: <sup>[OrigE]</sup> "I was speaking about the bark and the branches because around the roots I guess it might be difficult because of the stones. This would enable us to find a relation between the growth of the bark and of the branches and to measure the danger for the stone because they are most probably closely related. I don't know, maybe this needs to be checked."

Answer from Mr. V.K. Gupta: <sup>[OrigE]</sup> "this is possible but at the same time if there are available spaces for the growth of the roots then they will grow, but if there is obstruction at one end or one place then they will change direction. But it is a very good idea about sensors that could be put in place to measure the future dimension of the root, thank you."

Contribution from Mr. Pierre André Lablaude: "I would like to come back to our Indian colleague's presentation on the trees at Ta Prohm. I believe that the intervention shown this morning perfectly demonstrates that a vegetal heritage such as trees can be analysed in the same way as a building is. One needs to follow the same approach: measured drawings, questions on the dating, monitoring, diagnosis, drawing of a risk map, prescriptions for conservation and reinforcement of the structures even, if these are living and not dead. All experts who are associated with conservation of a vegetal heritage, such as I am in France with Versailles, can only approve of the chosen approach and methodology as was utilised by our Indian colleagues. Let's congratulate them for the quality of this presentation. But I express a concern regarding the technique employed to strengthen trees. The technique used to prune trees can be seen in several sites in China, which shows that it has been practiced for centuries: to conserve an old tree, it needs to be pruned. Yet, I think that assimilating this with constructions is dangerous for the filling, to fill the cavities. This was experimented with in Europe several years ago. 20 or 50 years ago it was often the case that when a tree was hollow it was filled with concrete as we thought it would strengthen it. Then, filling techniques such as resin mixed with sawdust were used and after a while, as we found out in Versailles, every time we tried to fill a tree by filling its cavities, we only ended up accelerating the decay and that the best treatment is to have on the one hand a propping to guarantee the stability of the tree and on the other to clean the wounds as much as possible. Also, maybe a cicatrising treatment could be used; but, always remain cautious when employing filling techniques. Thank you"

Answer from Mr. V.K. Gupta: <sup>[OrigE]</sup> "yes we are aware of the measures that need to be taken for the filling of cavities and when you mentioned filling with cement, this is not a

solution in use nowadays and damages the tree. So instead of cement filling, the cavity can be filled with light flexible material like polyurethane foam. We always use the best technique that is available worldwide. As for supporting the tree from outside it is again a good idea. Thank you very much."

Question from Mr. Santoro: <sup>[OrigE]</sup> "I would like to ask a question to the Chinese team related to the structural analyses of the Ta Keo temple, and in particular about the soil of the filling of the temple as I did not see if there was any analysis of it. Because we realise, and this is based on Pre Rup but also our Angkor Wat experiences, that seepages, infiltration of rainwater which have been there for a long time, changed the condition of the soil inside and worsened the condition of permeability immediately at the rear of the retaining wall. This is due to the action of silt in the layer immediately behind the retaining structure. This reduces the permeability of the layer immediately in contact with the retaining structure, increasing the water pressure thrust. We have based our calculations on this model and I would like to have your opinion on it."

Answer from a representative of the Chinese team: <sup>[OrigE]</sup> "This is a technical question and I am not a geologist but I know that there are some problems similar to the one you mentioned. In Ta Keo the drainage system was broken so the seepages reached the soil and the foundation was weakened. I have a detailed report which you can look at."

Question from Mr. Tan Bun Suy: "may I introduce myself, Mr. Chairman? My name is Tan Bun Suy I am a Deputy Director of the APSARA Authority in charge of agriculture and community development. My intervention bears no relation with agriculture but regards the nature of the rocks. I am very interested in the materials used at Angkor, at the Bayon and Ta Keo, as there are all different. I think that when carrying out restitution and conservation one should be in full knowledge of the nature of the rock, as their reactions to weathering or biological agents are different, depending on their chemical content. For example, at Angkor Wat and at the Bayon the content of feldspar and plagioclase is different. You certainly are aware that the good conservation of Banteay Srei comes from the material, which is pure sandstone with no plagioclase or mica. Thank you very much".

Contribution from Mr. Azedine Beschaouch: "we already expressed our satisfaction when the presentation on the Bayon was made and I have a question for Mr Royère. When you presented your site and the area with missing parts, you replaced them with new stones. Now I would like to know how you plan to harmonise it all. Are you going to use ageing products as was done by some, or will you treat the whole monument afterwards, so that this successfully restored monument could rapidly not look like it has just been restored, although this may cause some ethical issues and some are in favour of this; for example in Italy, people who want to emphasise the differentiation between the restored area and the new area, a stance that many of us find unbearable."

Answer from Mr. Royère: "you are actually referring to the Venice Charter, which advocates, in ancient structures, clearly make a differentiation when new materials are used even if the same type of stone was used. The problem to be clearly analysed must be cross-referenced with other monuments. The Elephant terrace was restored during the 1960s by the EFEO and the Angkor Conservancy. A section of the south stoop presented severe missing parts. This section was treated respecting the Charter and, in order to respect the authenticity, made a clear distinction between the old stones *in situ* and new additions. This means that the decor was not completely carved but rather carved only in its outline. For example, the profile of an elephant can be seen in order to keep the continuity of the contour, but the carvers did not carve the whole décor. This aged well and is perfectly understandable on a structure such as the Elephant terrace, notably on this stoop because there is coherence and one can see that a section was treated and the lack of décor actually does not disturb.

As for the Baphuon, we are in a different configuration. Firstly because we have not treated only one wall; there are a huge number of missing parts to be treated, often entire walls over three storeys and four facades, insertions which are not only aesthetic and cul-

tural but predominantly structural. Our concerns followed several stages: there were discussions during the ICC and also internal ones within the team. Several solutions were tested but there are such a large number of broken pieces and alterations found on the ancient masonry that need to be restored. There is, for example, no continuity on a moulded wall with several unknown areas showing. So with relation to this alteration which is part of the decor and is visually striking, there are three approaches: to treat the decors to assert the difference between what is new and old. A smooth wall is left as was done on the Elephant terrace but if you multiply this by four facades over three storeys and four pavilions, the risk is to end up with something looking like a multiplication of smooth surfaces bearing no relation one to the other.

Another approach would be to re-carve the whole décor, trying to show that by not ageing the stone, we highlight what was inserted, but this distinction will age and last and what existed before was re-erected. But due to the multiplicity of the areas this might end up looking like a patchwork, where what will be the most legible is the intervention of the restorer to the detriment of the building, which the restorer is supposed to respect. The selected solution, following several discussions and which was applied on the upper levels is: to carve the decors as if they were new then to mechanically age them without using any products, and I would like to underline this because nature here usually does that job very well. If you let a stone exposed for two years to one dry season and two rainy seasons, usually it won't be distinguishable from the ancient wall. So the decision taken is that with the large number of new elements and their distribution on the monument, we try to remain humble with relation to the monument and try to keep the insertion as discreet as we can, by ageing the stone while trying to disguise the discontinuities between the modern and ancient structures. Then remains one last problem: legibility. The visitors are not always familiar with the work of the conservator and the authentic section of the monument, so there is a concept of the harmony of the monument. But the vision of those who are knowledgeable about this must also be satisfied.

There will be graphic archives available for those who are interested. These archives will be available at the APSARA library. Experts will be able to read about the history or the ageing of the stone, to locate where insertions were made and how they age. At the same time, and this is one of the objectives, the visions of the scientist, of novices and also of those who are not aware of conservation techniques will also be satisfied. The technique used is to carve the surface of the stone at the end of the process with a kind of scissor, a diamond point chisel, which grooves the skin of each stone. These grooves are visible when one stands 1.5 or 2m away but from further 3 or 4m these details cannot be seen and do not impair the cohesion between the old and the new elements of the monument. I hope I have answered your question."

Observation from the Co-chairman for Japan: "I believe that time and agenda oblige us to close this discussion session. Let's now listen to Mr. Croci's presentation on the obelisk of Axum."

**Mr. Giorgio Croci:**

[OrigE] ♪ Excellencies,  
Ladies and gentlemen,

I am sorry that it takes a few minutes but I hope I will be able to present once the technique is ready. [slide] I would like to briefly present the problem of the obelisk that was taken from Ethiopia 70 years ago. It collapsed due to an earthquake and broke into several pieces. Then it was taken to Rome and after 70 years an agreement between the Italian and the Ethiopian governments established the return of this obelisk to Ethiopia.

[slide] It was not easy to separate because some bolts were put inside, sealed with cement. So we prepared a steel structure all around the monument then used jacks to pull and separate the parts. [slide] Here are pictures; these are the jacks and this is the moment [slide] when the connection was broken and the bolts started to come out of their holes and

[slide] this is the provisional steel structure that was used to separate the pieces. [slide] Manometers and computers to control the operation were also used.

[slide] This is the separation moment between two blocks. The weight of the block for the biggest was 75 tons and there was a huge problem, which was how to bring these elements back. [slide] So an Antonov was used, as it is the biggest aircraft in the world. In this picture is the moment when the pieces were put in the aircraft. I was on this first flight and when we arrived at Axum people were waiting and showing great enthusiasm. And then at the airport the pieces were brought on site. After a few months, [slide] here is another obelisk which collapsed due to bad foundations. And as this one was leaning we put up provisional propping because we did not want to see another collapse, so it was as a precaution.

[slide] Here is the steel structure that was built and the crane to lift the blocks one after the other. [slide] For the connection some carbon fibres were put inside with epoxy resin in order to provide seismic resistance. [slide] This is the moment when it is almost complete and here you can see everybody showing their happiness for the return of the obelisk. Thank you very much."

Comment from the Co-chairman for Japan: [OrigE] "before we take a break I would like to ask Sophia University to make a presentation on the preservation of Angkor Wat phase II."

## II.10 Presentation by Sophia University, Tokyo

### a. Conservation Plan for the Western Causeway of Angkor Wat, Phase II Mr. Satoru Miwa, architect

[OrigE] "My name is Miwa Satoru from the Sophia Angkor Mission I would like to give a presentation on behalf of Professor Oki Ishisawa, director of the Sophia Asia Centre

[slide] First the restoration project on the Western Causeway of Angkor Wat. Sophia University has carried out this project since 1996. Phase 1 of the project, 100m out of 240m, was completed in November 2007. In July 2008, at the ad hoc group of Experts of the ICC, Sophia University proposed the planning of the project. This plan was fully accepted by both the ad hoc committee and the APSARA National Authority.

[slide] 1 The Proposed Plan of Phase 2 of the Project

The Project Plan of Phase 2 is as follows.

- 1) Site: a total of 140m (100m of Area-2, and 40m of Area-3)
- 2) Implementation: APSARA National Authority
- 3) Project management: APSARA National Authority
- 4) Site management: APSARA National Authority
- 5) Procurement of manpower & materials: APSARA National Authority
- 6) Schedule management: APSARA National Authority
- 7) Manpower training: APSARA National Authority
- 8) Budget: APSARA National Authority
- 7) Technical assistant: Sophia University.

[slide] This shows the organizational chart between Sophia University, the APSARA Authority, the ICC and ad hoc experts."

### b. Stabilization of six parts of Banteay Kdei temple structure, by Mr. Satoru Miwa, architect.



[*OrigE*] “Sophia University has maintained Banteay Kdei temple since March 1991. This maintenance includes activities such as erecting wooden supports for the dangerous parts, as well as cutting trees and branches likely to be harmful to the structures, and the cleaning of the site. [*slide*] In 2008, Sophia University submitted a special report to the APSARA National Authority mentioning seventeen (17) dangerous parts, including six (6) that were serious. The APSARA National Authority has carried out the preservation of these parts, for the prevention of accidents by the falling stones to visitors. These processes present a typical case of the handing over of the maintenance of the Banteay Kdei temple to APSARA National Authority by Sophia University.

The preservation of Banteai Kdei temple by the APSARA National Authority: the APSARA National Authority temporarily treated six (6) dangerous parts of the Banteay Kdei temple during a period of two months from January, 2009, based on suggestions by Sophia University. The treatment activity was implemented on the initiative by the use of its budget. This included the procurement of manpower and materials. We understand that all these activities were implemented and managed by Mr. Mao Sokny, APSARA DMA, a Cambodian architect who was assigned for the preservation work of the western causeway of Angkor Wat for a period of ten years. He moved from the Sophia Asia Center for Research and Human Development to APSARA in 2008.

The basic principle of Sophia University is that the monuments and sites of Cambodia should be conserved and maintained by Cambodian nationals. So, Sophia University should do our best to help and support the conservation and maintenance activities implemented by Cambodia. Also, the handing-over of technical elements by Sophia University to the APSARA National Authority is much more desirable now than before, because APSARA maintains a well trained staff. We can point out three examples of this handing-over that have occurred. The first is the recent maintenance procedures of the Preah Norodom Sihanouk-Angkor Museum. We are inviting the technical staff for ten months of training in Japan this year. They will study museum management. The second is Phase 2 of the conservation project of the western causeway of Angkor Wat, and the third is the temporary treatment of the serious portions of Banteai Kdei temple.

As mentioned, Sophia University has handed over, conservation, management and maintenance to the APSARA Authority. Regarding our training activities, professor Endo will make a presentation tomorrow. Thank you for your attention.”

*Comment from the Co-chairman for Japan:* [*OrigE*] “are there any comments on this presentation? [Few seconds of silence] No, so if we look at the agenda it is becoming very tight, we have to listen to five more presentations, which should take 55 minutes, let’s say one hour, I think these are very important items and that the discussions should be the highlight of this session. So I will give you a ten minute break and we will return at five to five to start the session on stone conservation, and I would like to ask the first presenter, Dr. Hans Leisen to be ready on time, thank you very much.”

## II.11 STONE CONSERVATION

### a. Guidelines for the conservation of stone monuments, by Dr. Esther von Plehwe-Leisen, GACP (*German APSARA Conservation Project*)

[*OrigE*] “Excellencies,  
Co-chairmen  
Ladies and gentlemen,  
Friends,

We have already presented regarding stone conservation in Angkor and our philosophy. [*slide*] Stone conservation becomes necessary in Angkor because we find scenes like this

everywhere, showing damage to sandstone reliefs, and also on other parts of the temple. <sup>[slide]</sup> They present stones catalysed by conservation measures. This made us think of having guidelines or recommendations for stone conservation, as conservation interventions, guidelines and instructions for the conservators are necessary and are normal tools for architects or engineers.

One institution that sets up such guidelines for practical work is the WTA (Scientific-Technical-Committee) in Germany. <sup>[slide]</sup> In this working group there are experts and they draft these kinds of leaflets for different restoration and conservation tasks. These leaflets are generally accepted, and when major projects start they are usually formulated on the basis of this leaflet. The leaflets are also available in English.

Of course a leaflet needs to be updated. Here is one leaflet dealing with water-repellent treatments originally dating from 1984 that has been updated and revised and is now on its way to being published. I would then like to introduce you to this leaflet and also to its possible application for the temples here in Angkor.

We also have the problems and damage that have been catalysed by hydrophobic or water repellent treatment that we have seen from pictures in your presentations. We have these problems in Angkor. And it would be very nice to have water repellent treatment. <sup>[slide]</sup> Here if we look at the damage caused by water on stones we can see that the blue areas are processes correlated with water. So maybe the preservation of monuments could chiefly be to protect them from water. This could be done by roofing, creating a good drainage system or water repellent treatment.

The functions and principles of such water repellent treatment or impregnation is that the pores of the stones are modified in such a way that water cannot enter these pores any longer, or in a more concrete manner that water is no longer not sucked in the pores. <sup>[slide]</sup> But, on the other hand, water vapour is still able to migrate through the material. Most agents that are used nowadays for water repellent treatment are silicon resins, or organic siliceous materials. There are different types of these silicon products. We have mixtures of different products in organic solutions, aqueous micro emulsions and creams. <sup>[slide]</sup> This is to show you that there are special agents we use for special situations, so that these products can be tailored to the situation they are facing.

The first question we have to answer is whether we want a hydrophobic treatment or do we need a hydrophobic treatment. And to assist this leaflet presents some ideas: the first is the type of material and how it absorbs water. If it does not absorb water then we don't need water repellent treatment. The leaflet gives  $1 \text{ kg/m}^2\sqrt{\text{h}}$ , which is low for water uptake, specialists favour  $2 \text{ kg/m}^2\sqrt{\text{h}}$ . <sup>[slide]</sup> If you look at this picture you will read the different water uptakes for the temples of Angkor: the first is Angkor Wat, then Bayon and Pre Rup, and there are only three temples which are in these margins.

Is the material sensitive to moisture? If it is not then we don't need a water repellent treatment. <sup>[slide]</sup> Here is a section of Angkor Wat's section and you can see that there are a lot of minerals and they are sensitive to moisture. According to the leaflet, only a positive answer to both questions can justify a treatment, so, if we look at Angkor sandstones, we have a more or less positive answer to both. There are more requirements if you want to use a hydrophobic treatment. With the high humidity in Angkor the question is: can a water repellent treatment Help to preserve Angkor's temple structures?

The absolute precondition is to make sure to use a water repellent treatment with no damaging action and that uncontrolled water intrusion into the stone which is hydrophobic or has been treated must be impossible. This is one precondition: the other is that the damaging impact on the stone may not be enhanced. This is self-explanatory; there is no need to dwell on this.

I would like now to illustrate the first precondition: <sup>[slide]</sup> here you have the dry hydrophobic or water repellent stone after treatment and here inside you have the stone. If

you are not sure that you have no water entrance, then of course you will have transport mechanism to the dry surface, of damaging salts and different mechanism that works with water inside the stone and here in red this scale will detach from the stone and incur damage.

Other preconditions fulfilled by the monument structures

- the water run-off system must be in order,
- the joints have to be in good condition (firmly closed by mortar),
- no hollow spaces, cracks or fissures may be existent.

[slide] If we transfer these preconditions onto Angkor temples then these preconditions are not fulfilled. We have a lot of open joints, a lot of hollow spaces, no organised water runoff system, and a lot of intrusion of water along the joints and cracks.

Another precondition:

- condensation inside the building must be absent,
- no rising damp at the building

[slide] So if you look at these pictures, you can see the rising damp on these blind doors, and today throughout the presentation water problems on the monuments have been a focus, so these preconditions cannot be assured.

Caused by the method of construction of Khmer temples, which feature dry joints without jointing mortar, with false vaults and low foundations, and the influence of large bat populations that produce damaging salts, no Khmer temple can fulfil these requirements after many hundreds of years (Figs. 6 & 7).

There are also preconditions to be met concerning the building materials:

- an absence of expanding or swelling components e.g. clay minerals. [slide] If you look at this picture of sandstone we can see these small particles, which are clay minerals, and we carried out test to find out if they are swelling or non-swelling clay minerals, and here we have a high rate of swelling in samples from Angkor Wat; in the other there is swelling but it is not as important. In this region the damage of clay minerals starts. An experiment was made with swelling sandstones; they have been treated with hydrophobic agents. After this treatment the swelling was enhanced.
- An absence of dense surfaces due to sinter, salts, crusts or biocolonisation or other effects that densify the surface.
- An absence of hygroscopic salts,
- An absence of contraindication, due of former conservation measures previously carried out.

[slide] Let's look at investigations made of Angkor Wat samples. If we look here on the surface we have high salt content. If we calculate with the cut-ends we have ten percent of soluble salt in this surface, which is of course densified by this ten percent. [slide] If we look at this picture, which is familiar to those working in Angkor, this is iron crust which also densifies the surfaces.

So if we want to answer the question on Angkor monuments and see if they are likely to become hydrophobic following treatment, then we have to say that the requirements for safe water repellent treatments are unfulfilled in nearly all Angkor monuments. Hydrophobic treatments could have other positive effects. [slide] Therefore, we carried out investigations in other parts of the world. Here you see the Munich Court; it has been treated and cleaned by water repellent treatments and if you look at it, this is a picture taken ten years later and there have been no positive effects regarding soiling. After cleaning there is still the same soiling, as we would have without water repellent treatment. Another point could be the microbiological colonisation; maybe it has a positive effect on microbiological growth. Here, this was a cleaning which took place in Angkor. The colour is red now and the problem is that the original microbiological growth has been eliminated and that a new microbiological growth has found ideal conditions on dry surfaces: this colonisation thrives and is very difficult to clean.

There are not any other positive side effects, but problematic such as the durability of the water treatment. <sup>[slide]</sup> Here we have measurements of the water uptake eight years after and 15 years after hydrophobic treatments on the cathedral of Cologne in Germany. We can see that the treatment decreases as time passes by. There are around 500 measurements in different sites in Germany and they bring the same result, showing that the efficiency rate is increasing depending on the types of treatment, and after ten or fifteen years the treatment is no longer efficient. So, when the treatment effect is over we need a re-treatment which brings the problem of densifying the surfaces: the moisture transport is changed and densified, so there won't be any more exchanges.

To conclude: a water repellent treatment is an irreversible measure and may have severe consequences. After ten years the hydrophobic effect is reduced, and re-treatment becomes necessary. Re-treatment can impede permeability for moisture; the drying of the stone can be hindered considerably. The preconditions for a safe water repellent treatment are fulfilled neither by the Angkor temples nor by most Angkor building materials. Hydrophobic treatment is not suitable for Angkor monuments.

Due to the special situation of the Angkor temples and the properties of most building stones a water-repellent treatment may not be a tool for stone conservation in Angkor. Thank you very much."

**b. Sandstone conservation in Angkor, by Elke Tigges, adviser, APSARA Stone Conservation Unit, DED (*Deutscher Entwicklungsdienst, German Development Service*)**

<sup>[OrigE]</sup> "Excellencies,  
Co-chairmen,  
Ladies and Gentlemen,

<sup>[slide]</sup> Last year, the presentation of the Stone Conservation Unit was given by my Cambodian colleague Mr. Long Nary, who unfortunately cannot join us today. He is instead participating in the 16<sup>th</sup> International Course on Stone Conservation in Venice together with 20 other stone conservation experts from 20 different countries.

Today, I have the great pleasure of presenting the work of the Apsara Stone Conservation Unit. My name is Elke Tigges; I am an architect, specialising in ancient monuments. I work for DED (*Deutscher Entwicklungsdienst*), and our Cambodian partner organisation is the APSARA Authority. <sup>[slide]</sup>

I am the advisor for the establishment of a permanent Stone Conservation Unit in DMA 1 of the APSARA Authority. At the moment we have three local experts in stone conservation. They have more than ten years' worth of training and work experience from GACP and for more than two years they have been working for our team. In the near future we plan to take over more local conservators from GACP, to use the capacity built up by GACP. <sup>[slide]</sup>

Four months ago we moved our office to the Angkor Conservation Compound, the ground floor of DMA 1. We have a fully functioning workshop with necessary materials and machines.

Let me present some of the results of our work from last year:

<sup>[slide]</sup> At the East Mebon Temple we conserved the elephant and lion statues. Here on the right side you can see the risk map; the elephant statues on the corner have already been restored and the lions are still in danger, this dating from November 2008. As an example: the north-west elephant statue, here before our treatment: <sup>[slide]</sup> On the eastern side the statue had sunk by 12 cm and the front of the pedestal was broken. So we dug up

the ground, lifted the pedestal to get the statue in a correct balanced position and connected the broken part.

The feet and legs of this statue were in a very bad condition. So we secured the scales, filled cracks and opened joints. The gaps inside the scales were filled by injection and a big *lacunae* was refilled with a piece of new sandstone.

Luckily, we found two large pieces of the trunk in the forest, which we reattached to the statue, here on top of the picture. <sup>[slide]</sup> The lower missing part of the trunk is stabilised by a new piece of sandstone, carved by the Chinese team.

All the materials and techniques we use have been tested for more than ten years by GACP and the University of Applied Sciences, Cologne. There is, for example a special sandstone mortar, which has the same physical characteristics as the original stone. Or the special wash, which consolidates the surface, but, does not close the pores or the fibre glass dowel, which are very stable and flexible.

<sup>[slide]</sup> On the central west side of the pyramid we found a lion statue, half covered by earth. The archaeologist from APSARA Authority helped us and excavated it, <sup>[slide]</sup> we conducted our intervention and reattached a piece of the right ear and the face.

<sup>[slide]</sup> At the Victory Gate we carried out an emergency intervention for DMA1; some demon statues had lost their heads during a storm. So we reassembled the body of the 2nd demon and connected the head of the 2nd and 3rd demons back in position. Luckily we found another head, of Demon 9, which we also reattached.

<sup>[slide]</sup> One important activity of our unit is networking with other teams and offering our expertise to national and international projects. On a regular basis, we give technical advice to the WMF Project at the CSM Gallery, on conservation of the roof stones.

<sup>[slide]</sup> We also worked for the Phnom Kulen Archaeological Programme, in cooperation with two conservation experts from GACP. On the left photo you see my colleague mapping decay before the intervention on the bas-reliefs at Peung Thabal Cave on Phnom Kulen. We gather documentation and we are collecting data at the site of each intervention. In the other photo, the scales of a column at Prasat O Paoung are fixed by gluing the dowels with Sikadur glue.

<sup>[slide]</sup> Some smaller objects were brought to EFEO and the Preah Norodom Sihanouk-Angkor Museum for restoration and security reasons. As an example I would like to present this sitting statue which we reassembled from more than 24 pieces.

<sup>[slide]</sup> In my last slide you see eight unique stone crosses in the shaft of the laterite pyramid of Prasat Reung Chen. We conserved four crosses and reassembled some broken parts. In this photo you can see them back in the original positions.

We restored 20 objects from the Phnom Kulen. Now the sandstone objects are stable again. It is important that they receive regular maintenance in the future. Our intervention cannot stop the decline; we only help to slow down the process considerably.

These results were achieved thanks to the support and cooperation of the APSARA Authority, DED and GACP. I would like to thank these organisations for this.

To all the technical teams and their representatives here in the room: the Stone Conservation Unit of APSARA, with its advice, is ready to cooperate with you. Let us move forward jointly towards our common goal: the safeguarding of Angkor.

Thank you very much for your attention."

**c. Research on microorganisms at Ta Nei temple for the conservation of stone monuments, by Ms. Yoko Futagami, Tokyo National Research Institute for Cultural Properties**

[OrigE] “Thank you very much, Co-chair, Excellencies, Ladies and Gentlemen. I will present our research on microorganisms at Ta Nei temple, Angkor, for the conservation of stone monuments.

[slide] As we mentioned before, there are different effects of microorganisms on stone. One is visual reaction. Microorganisms can alter the appearance of the monuments. If they are on inscriptions or reliefs, we cannot fully appreciate the value of the monuments. But, on the other hand, microorganisms can add some atmosphere by putting a “patina” on the monuments.

They also have physical reaction. Lichens, mosses, and algae will be the breeding ground of higher plants, which may have a negative effect on the monuments. But, on the contrary, it is also said that these microorganisms, especially lichens, can prevent much severer weathering of stone by covering its surface.

Besides, the hyphae of lichen penetrate the stone surface. We have some results regarding this topic, it is true their hyphae go into the stone surface, but the real effect is not certain for the moment.

There can be chemical reaction. Lichen acid or other chemicals from lichen are said to deteriorate the stone surface, but some lichenologists say that the lichen acid is not so soluble in water, or not strong enough to have any influence on stones.

We have been conducting our research at Ta Nei Temple since 2001. [slide] You can see the temple is surrounded by trees, and covered with mosses and lichens. [slide] Our study area is shown in this map. Apart from Ta Nei Temple, we have been conducting research at the foot of Phnom Kulen, where ancient and recent stone quarries are located.

[slide] First we will introduce our studies on lichens. Since 2005, field studies on lichen have been conducted four times, collecting approximately 300 specimens from Ta Nei and sandstone quarries. A small amount of stone with lichen samples is necessary for our study; we obtained such samples with the permission of the APSARA National Authority. The field investigation was followed by laboratory investigations that were performed to evaluate the relationship between the deterioration of stone at the site and the microorganisms found in this region.

[slide] Through the taxonomic study, 57 species, 42 genera and 21 families were identified in total. Many of them were reported for the first time in Cambodia, and there may be some new species. Our lichenologists are now preparing a paper describing them, so I cannot inform you of the details at the moment.

[slide] Some of you might remember that we reported last year that crustose and squamulose lichen extended their hyphae into the stone surface from 7mm to 20mm. We found some lichen which had penetrated the stone surface with their hyphae much deeper. A detailed report will be presented at another time.

[slide] We now introduce the investigations on the effect of microorganisms on stone surface. Last time we presented our results by using the equotip hardness tester. You can see the part, it is very small. We can perform the experiment on the monument or stone samples.

[slide] As shown here, the hardness of the sandstone after the removal of surface mosses is approximately 30 percent less than that of fresh sandstone, and also less than that of sandstone with lichen.

[slide] This time we performed the measurement of the magnetic susceptibility of sandstone surfaces with/without microorganisms, by which I mean lichens and mosses, with consultation from Dr. Uchida.

[slide] Here we have the values of magnetic susceptibility. There was a great variety of the values between the samples, but in case of the proportion of the values in the same sample, values of mosses divided by those of crustose lichen were between twenty-nine point two to seventy-four point seven, but the values of foliose lichen divided by those of crustose lichen were between seventy-eight point six to one hundred seventeen point eight, and we can say there's a difference between the two.

Observation by a polarizing microscope revealed that the surface of the sandstone covered with mosses is porous, showing that the surface is weathered. You can identify the brownish layer observed under the mosses; this kind of layer is not observed on the stones with crustose lichen.

Our investigation revealed that the presence of mosses on the stone surface was associated with the weathering of the rock substrate; however, our results did not provide sufficient basis to determine whether the presence of mosses was the cause or effect of the weathering.

Environments that are conducive to dense growth of mosses are considered to hamper the conservation of sandstone, even if the mosses do not actually accelerate the weathering of the stone. So, environmental improvement of this site to reduce the relative humidity can be proposed for the better conservation of the sandstone of this site.

[slide] Now our taxonomic study on lichen is almost complete. We also found some lichen's hyphae grow into the sandstone and laterite. Therefore, quantitative analysis of the relationship between the difference of species and the hardness of substrate stone will be possible. Investigations to assess the chemical effects of lichens on such stone substrates are currently underway. The results of our study revealed the existence of a correlation between the hardness of a stone sample and the presence of mosses on its surface; however, the details of the cause and effect relationship remain unclear. It is possible that weakening of the stone surface accelerates the growth of mosses or that the growth of mosses on stone weakens the stone surface. Moreover, we plan to examine the possibility of controlling the growth of these microorganisms by regulating the surrounding environmental conditions.

[slide] Apart from the cooperative research conducted in Southeast Asian countries, we have been doing comparative studies in our own country. Here is one of the examples. This site is located in Nagano prefecture, central Japan. This is a shelter of a small pagoda on the left side. It is made of granite, and built in the late 13th century. The monument was treated with waterphobic resin around 20 years ago.

[slide] As you see, southern and northern parts of the roof show the different rates of moss growth, on the left of the picture is the south and on the right is the north. We measured the crown densities, which mean the rate of open sky, rate of evaporation and smoothness of each part. The northern part showed a lower rate of crown density, lower evaporation and higher roughness than the southern part. We also found the treatment by waterphobic resin was still effective by checking the shape of dropping water. We concluded that these factors, evaporation and roughness, made the difference. This example indicates the importance of controlling the environment, as well as the treatment of stone surface.

[slide] In conclusion, we will introduce our recent experiment a little. To understand the cause-and-effect relationships between the existence of microorganisms and hardness of stone, we installed some pieces of newly quarried sandstone within the area of Ta Nei Temple last July. Dr. Shimoda kindly prepared these samples. I visited the temple the day before yesterday and found that some of them are covered with algae. I suppose it takes

more time to have mosses on the surface, but we expect our results in the near future. This is an artistic picture that I took and the sample had mosses I checked it myself in December, but unfortunately it was lost.

Thank you very much for your attention.”

**d. Investigation of Western Prasat Top (2008-2009), by Dr Tomo ISHIMURA, Nara National Research Institute for Cultural Properties**

[OrigE] “Excellencies,  
Honourable Co-chairmen,  
Dear colleagues,  
Ladies and gentlemen

Today I would like to present the Nara Institute’s activities in the Angkor region in 2008-2009.

1. Archaeological excavation

[slide] The ninth excavation was carried out in August 2008. The trench was opened in the eastern front of the south tower and in the southern front of the central tower, in order to examine the understructure of the buildings. The excavation revealed that the soil underground was not well-compacted. We consider that this is one cause of uneven subsidence of the superstructure. Brick pavement was unearthed in front of the eastern stairway of the south tower at a shallow depth. The distribution of the pavement was limited. We do not have a clear idea about this feature yet.

The tenth excavation, planned for December 2008, was cancelled due to social unrest in Bangkok.

2. Architectural research

The second fieldwork for architectural research was carried out in August 2008. The research included: 1. Making floor plans for the platform and each storey; 2. Making cross-section drawings at several transects; 3. Making elevation plans; 4. Documentation of mason works and stacking patterns of stone materials; 5. Measurement of each stone material; 6. Documentation of the current condition of stone material; and 7. Making of reconstruction drawings. The work is still in progress, and the next fieldwork will be carried out in 2009 to complete major activities. [slide] This picture, for example, shows the plan of the platform and each value of the elevation from sea level which indicates an uneven subsidence of the platform. This work is important not only for recording and documentation of current status of the site, but also for providing reconstruction plans for future dismantling and reassembly.

3. Preliminary research of conservation science

Fieldwork for conservation science was carried out in February 2009. The research includes three contents: 1. hydrothermal environment analysis of the stone structures by thermograph measurement; 2. stiffness or hardness measurement for the stone materials by ultrasonic elastic wave exploration; and 3. preliminary research for three-dimensional modelling. The 3D modelling by digital camera images was carried out in our previous research; however, the data for the upper part of the central tower is incomplete, because it was covered with vegetation at that time. We are going to amend the missing data and also try to obtain high-precision 3D data, such as modelling of sculptures and statues.

4. Conservation of the site

[slide] At present, the structure of the site is unstable and fragile, and partly collapsed. A part of the top of the central tower collapsed in May 2008. In the wake of the collapse, following the suggestion by the APSARA National Authority, we installed metal scaffoldings and supports to the site. The JASA team kindly loaned the materials and



helped with the construction. We are grateful to them. Through this temporal treatment, the condition of the site has been stable so far. We are thinking about the next step, such as dismantling for repairs and reconstruction (in part or total). Full-scale operations for repair are to proceed through mutual consultation with the APSARA National Authority in future.

#### 5. Tani kiln site ceramic museum

The Nara Institute was engaged in the investigation of the Tani kiln site in the period between 1995 and 2000. In cooperation with the APSARA National Authority, the site museum is going to be built at the village of Run Ta-Ek, by grants-in-aid from Japan's Ministry of Foreign Affairs. It will open early December 2009 for the next ICC meeting. Thank you very much."

#### **e. Trial reconstruction of the scenario of contemporary sandstone deterioration on the Takeo central pyramid (1905-2008), by Prof. Marie-Françoise ANDRÉ, Blaise Pascal University, Clermont Ferrand, France**

"Excellencies,  
Ladies and Gentlemen,

As you might be aware, our team has been working for the past three years on the sandstone decay of the mouldings of Ta Keo. Our research is carried out in parallel with the project regarding the stability of the building implemented by the Chinese team, supervised by Professor Hou Weidong, whom we met on site.

[slide] We are analysing the three upper tiers of the central pyramid of this 1,000 year- old temple mountain, which was cleared from the forest in the 1920s. We have decided this year to show you the first outcomes of the diachronic photogrammetry. Let me remind you what it consists of. [slide] By working on old pictures and superimposing them onto present pictures, we can retrace the scenario of the contemporary decay of the mouldings.

[slide] Ancient iconography is abundant and mainly comes from works carried out by the EFEO and the Angkor Conservancy. Our main sources are: for the 1960s, the private collections of Mr. and Mrs. Nafilyan and of Mr. Dumarçay and photos taken by Mr. Bernard Philippe Groslier and kept at the Guimet Museum; for the 1920s-1930s, pictures from the EFEO picture library; and, for the 1990s, the pictures published in the remarkable book "Ruines d'Angkor", by Pierre Dieufils.

[slide] This picture, taken in 1905, of the first tier of the third storey of the central pyramid, is one of the key components of our databank. [slide] It enables us to measure the contemporaneous decay of the mouldings (in yellow) with relation to the decay of the previous nine centuries (in red). To summarise, the speed of decay of the stone has multiplied by ten since the temple was cleared. [slide] This is particularly striking on its median torus, which was almost unaffected before clearing and [slide] where in the course of the 20<sup>th</sup> century erosion scars appeared, for example, this one here. We can even trace the different stages of its development. The last picture we used was one taken by Mr. Dumarçay in 1994. I take this opportunity to call for pictures, as we are looking for other photos taken in the 1980s-90s, pictures which we are in need of.

[slide] In other sections where our collection is more complete, one can try to elaborate an evolution curve of the decay, shown here at top right. It testifies to a real acceleration of the decay in the early 20<sup>th</sup> century, following centuries of very slow decay, and from the 1960s the continuity up to the present of this decay at sustained but changing pace, depending on the tier of the pyramid:

- on the left on the first storey, a rapid pace materialised by the opening of new scars.

- To the right on the second storey, the pace of the decay subsides; the surfaces damaged during the past 40 years are shown in red.
- Finally, on the third storey and in the special context of mouldings sheltered by stairs with a microclimate which facilitates rapid vegetal colonisation of the stone, almost no decay has occurred over the past 40 years.

[slide] These findings concur with observations carried out under forest canopy, especially in Koh Ker and Ta Nei, where decor patterns in the shape of lotus petals are, in general, better preserved, whereas they literally 'burst' in Ta Keo after being exposed to the sun and the rain.

[slide] Our conclusion is three fold:

1. That acceleration of stone decay following hydroclimatic stress incurred when the temple was cleared is a fact.
2. The research programme must be continued for the next three years in order to better understand the mechanism and pace of decay. And, in the likelihood of an intervention on the mouldings, under supervision of the ICC and APSARA, we hope that these interventions will be carried out after a multipartite reflection engaging several teams working in Angkor, to which the GACP team, managed by Hans Leisen, should be the first to contribute.
3. Finally, the outcomes of the work carried out in Ta Keo prove the necessity of starting to take into account, during development works, the protective role played by the forest and associated biofilms. Therefore, the maintenance a forest canopy around the monuments is in line with a sustainable management of the Angkor site and its region.

Thank you."

## GENERAL DISCUSSION

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Observation from the Co-chairman for Japan: "I would like to open the floor for discussion regarding the five presentations on stone conservation, although time is running out".

Comment from Mr. Simon Warrack: <sup>[OrigE]</sup> "I would like to follow up on some point made by Esther Pewe Leisen on the hydrophobic films, which I thought was very interesting and conclusive in its results. I just wanted to point out, this is material that was used in the past a lot in Europe and she was talking about durability. I would like to stress this point because the durability is not very great: she mentioned 10, 15 years; actually it is very often shorter. When it is on a flat surface, it goes away perhaps in a uniform way, but when it is on the monument of Angkor in particular the roof in a wavy form, what has happened is that previously there was a black biological coating, they were cleaned and hydrophobic resin was supplied. Then over the years the action of water washed away the resin in the places where the water runs but left it where the water doesn't run. So the result is: before they were black, then they were cleaned; now they are stripy. So if you look at Angkor Wat you can see a lot of black stripes around the wall. And most of that is due to the differential removal of this hydrophobic resin. So it is a serious problem, because it becomes an aesthetic and conservation problem. It really needs to be considered, the point that Esther made, and that was my contribution to it. Thank you."

Comment from Mr. Mounir Bouchenaki: "I wish to make a comment on the latest intervention from Professor André. This presentation is raising questions, because it shows that uncontrolled deforestation may lead to stone decay, and I think that your presentation reflected this very well. This is the reason why, when visiting Beng Mealea on May 29, we have requested APSARA not to proceed with the deforestation, but rather to prepare a

management plan for the forest. I find your paper an example for what constitutes the forest canopy for the protection of the stone. I would like to add that there is at the moment in Venice a course on stone conservation. I think that the experts working for Angkor on stone conservation should also lecture in Venice and bring their knowledge. For those who have presented here, I will make sure with Professor Lazzarini that there is interaction between the conservators and the experts in stone conservation working in Angkor. Thank you”.

Question from Mr. Azedine Beschaouch: “I would like to ask a question to Mrs. André. What I found striking in this presentation is what she established, and I am guessing it will be confirmed in the coming years and months: how decay progressed due to clearing or attacks on the vegetal canopy and how it contributed to it. But she also said that historically, and she brings evidence to support this, that there were no decay despite other phenomena, etc. Does that mean that there was a vegetal canopy contributing to this protection?”

Answer from Mrs. André: “this is naturally a vast question, as in the early days of its construction Ta Keo was not covered by a vegetal canopy and remained as such for at least three centuries. We think that there was a clearance prior to the 20<sup>th</sup> century, but we don’t know exactly when. So the question can be asked: why was the last clearance a determining factor for the decay? There is a theory, which I submit to whole of you: in the early days when the stones were laid at Ta Keo—this is Mr. Dumarçay’s theory, although it is subject to controversy—the water held in the stone from the quarry evaporated and created a kind of shield although it could not have lasted very long. But it is rather difficult to give another explanation than the climatic stress caused in the early 20<sup>th</sup> century, if one looks at the damage observed when the site was cleared, and put them into perspective with what has happened for the past century. It is also hard not to mention climate change; another explanation can be that this was prepared while under the forest canopy. One tends to always oppose what is happening in the forest and in the open air. The reality is that when examining the lotus petals, as I said the skin of the petal is preserved, but there was chemical alteration of the lotus petals which might have penetrated the stone without damaging the pattern. And then when there is a change of microclimatic conditions from the forest canopy to the open air, then there is activation of the damp to dessication. The saline solutions are activated, and what was prepared and was undeveloped under the forest starts reacting. But to answer to your question this remains to me an enigma. But Mr. Verrot might have some additional comments to make. Shall I give him the floor.”

Question from Mr. Verrot: “actually it’s a question; we talked about this together before. The condition of the inner backfill of the monument needs to be taken into account as its nature has changed in terms of hydrometry and with the clearing of the vegetal canopy of the temple. Maybe there is something more to analyse; this surface decay might not be coming solely from the outdoor conditions, there might also be evolution inside the backfill.”

Comment from Mr. Lablaude: “these alteration phenomena of the stone are slightly better understood nowadays. In brief, there are two main points. On the one hand, thermal shocks, the difference of temperature between day and night and the amplitude; obviously if the item is in the shade, the amplitude will be less. Then the phenomena linked with soluble salt migrations conveyed by the water and crystallising on the surface. Therefore, there are two plausible explanations to this sudden start of the phenomenon which did not exist in the early stages of the monument. There might have been some layers on top of these décors, protecting them, such as paintings or a coating which might have protected them for a certain time. The second point is that these alteration phenomena are often following cycles. It means that these materials can live through 100, 200 or 500 cycles without any phenomena, and then phenomena are triggered from a certain threshold which is reached. I think we have entered this cycle and threshold, which explains the rapid acceleration of these phenomena.”

Question from an unidentified contributor: <sup>[OrigE]</sup> “you recommended that controlling the humidity level decreases or reduces the attack by lichens. But in an open structure like the temple here, how are you going to control or check the relative humidity?”

Answer from Mrs. Yoko Futagami: <sup>[OrigE]</sup> “this time we have not done a study on climate control, but we installed a measuring system in 2001 and also in 2006. So we have been checking the relative humidity and temperature change and some other factors. Does this answer your question?”

Question from the same unidentified contributor: <sup>[OrigE]</sup> “in an open area, humidity: how can you control it? In a closed space like a chamber you can always control relative humidity, but how can you do it in the temples in Angkor? Is it possible to control such humidity or are there any recommendations that could help?”

Answer from Mrs. Yoko Futagami: <sup>[OrigE]</sup> “we have also checked the relative humidity inside the temple areas, and the result which is measured by an instrument, shows some differences and that sometimes the humidity inside the temple area is higher than in Siem Reap, so we suppose this is due to the dense forest around the temple, so it is possible to control the number of trees and therefore to control the climate to some extent. Mme André also mentioned that climate change is not very good for the conservation of monuments.”

Comment from Mr. Tan Bun Suy: “I would like to bring my contribution on the alteration phenomenon of the stones following deforestation. The conditions in Angkor Wat are such that water is accumulated, drainage is very slow and in the water there is the presence of salts coming from the alteration of the rock, of phosphates and micas, but also from the guanos of bats. The guano brings in phosphate and the stone calcium. Water stagnates due to gravity then tries to escape through the sides. When there is forest around the temple, the humidity in the air is mixed with water charged with salt, which escapes as a liquid, bringing the salt to the surface of the stone; this will then be washed away by rainfall or other activity. But if you deforest, the humidity is less and the water, which used to escape, does not escape as liquid but as vapour. As you know, vapour does not convey any mineral components so the salts are locked in the stone and, after dessication, turn into crystals. And it is the strength of the crystallisation which forces the stone to burst. That is what I was able to study in France with the help of stone experts, thank you”.

Comment from Mr. Pottier: “a little addition to what was said by Professor Lablaude and to rebound on the likeliness of ancient coatings. I bring to your attention the fact that several historical elements testify to prior alteration and desquamation. One of these elements I am familiar with, as I worked for a while on it, and it can be found on the Royal terraces. The different works carried out there in the 20<sup>th</sup> century have exposed carved facings which were buried for centuries. We were then able to show that these phenomena of desquamation were already old, some of them dating prior to the 16<sup>th</sup> century, when some of these bas-reliefs which presented desquamations were re-carved. So there are examples of some changes of conditions, either climatic or of the situation of these blocks, which led to these phenomena, which are not a novelty.”

Observation from the Co-chairman for Japan: “as it is already late, I think we should close our proceedings for this first day. We will reconvene here at nine o'clock to talk about archaeology in Angkor, thank you.”

Announcement from Mr. Azedine Beschaouch: “the secretariat would like to remind you of an important invitation within the framework of the cooperation between Japan, UNESCO and the APSARA National Authority, concerning the JASA project. There is a large exhibition and you are all invited to come. It is not a temporary exhibition but a permanent one, and it is in constant evolution, which means that every time technical progress or new developments occur, then they will be added to the exhibition. I think that all the teams present here, either for technical, political or financial reasons, will be delighted to see the outcome of their work. It is like a temporary achievement of most of the works, obviously they are

all summarised, as it is difficult to present all the projects. I am sure that you will all be interested by this exhibition, which is only five minutes away from here."

**\*\* Conclusion of proceedings for Tuesday, June 2, 2008 \*\***

### **Wednesday, June 3, 2009**

*Announcement from the Co-chairman for France:* "I would like to draw your attention to the arrival of new participants, including Professor Fletcher and a delegation from Central America, which is here to study the parallel between the Latin America Maya civilisation and the Khmer civilisation. The topic is of interest and please be welcome".

## **RESEARCH AND CONSERVATION (cont'd)**

### **II.12 ARCHAEOLOGY IN ANGKOR**

#### **a. About archaeology in Angkor, by Prof. Claude Jacques, epigraphist and archaeologist**

"Honourable Deputy Prime Minister,  
Excellencies  
Ladies and Gentlemen,

If I am taking the floor today, it is because I would like to express the view of an historian of Cambodia, who uses epigraphy firstly for its research but also—and I actually could say nowadays predominantly—uses the findings from archaeological excavations carried out for more than the past ten years.

These excavations have brought a wealth of information. Of course, one could have guessed that the underground of Angkor was hiding many secrets and I often heard Bernard-Philippe Groslier say that he regretted the lack of time to explore the ground. To his great regret, he only carried out limited excavations in the vicinity of monuments. Things have changed there, with more workers on site, and the outcomes speak for themselves.

The first types of site are the archaeological ones: they will be reported on after my paper. The territory of the Greater Angkor Project of Professor Fletcher goes beyond the Angkor site. If the considerable amount of information gathered in many sites with different state of the art scientific tools, do not seem 'sensational', they are still highly interesting and cannot be overlooked by the teams working in Angkor.

More spectacular are the excavations and research carried out in the Roluos region, thanks mainly to the work of the EFEO but also, it needs to be said, to the interventions of several other teams: the Royal Angkor Foundation, GACP and of course APSARA. Christophe Pottier will give you an overview of the findings. The new data gathered have completely upset the history of the region and simultaneously raised some unimaginable new problems. It is known that each discovery brings along some new questions which could not be asked beforehand because these questions were not thinkable.

The excavations on the Phnom Kulen led by Jean-Baptiste Chevance are promising: they have already provided a lot of information and as you will later find out, there is hardly any doubt that they will bring more in the near future.

The excavations carried out in the city of Angkor Thom by Jacques Gaucher and his team have already provided new data but, obviously, we must wait before being able to draw the complete picture. These data are hard to coordinate as they deal with a huge area, the centuries-long history of which remains unknown.

I am delighted to hear that excavations have started on the major historical site of Koh Ker, under the aegis of the Royal Angkor Foundation, and I am eager to learn of its findings.

But I would like to insist on the results coming from two researches: namely that led by Mr. Ishimura Tomo, of the Nara Insitute, in the vicinity of monument 486, now called Prasat Top west, and of those carried out by our friend Pascal Royère around the huge working site of the Baphuon. These excavations are exemplary of what should be generalised in Angkor. They were implemented at the same time as the restoration project, based on the undeniable principle that: 'archaeology and restoration are two parallel fields facilitating the exploration and discovery of the real history of a site', as was stated by Mr. Ishimura Tomo in his June 2008 report.

The consequences are that now, a draft of the history of Prasat Top west is argued, a temple which up til recently remained unknown. Also, the history of the Bapuhon with relation to neighbouring monuments was substantially changed: for example, the pyramid of the Baphuon was built in the 11<sup>th</sup> century on top of an older temple—the history of which is unknown—and that the gopura 5 of the Baphuon, which was thought to be an addition dating late 12<sup>th</sup> century when the Elephant terrace was built, is actually older than the pyramid of the Baphuon.

Once thing is clear to us historians; what was written and seemed solid shall be modified, because the current proposed hypothesis can no longer be accepted. And this is the reason why, as an example, I have to update my guide on Angkor, which will include all the new data, which will then be integrated as coherently as possible to the former text and so on.

Yet, the findings of the excavations from the different teams are such that further actions must be taken; let's heed the words of Mr. Ishimura Tomo: 'archaeology and restoration are two parallel fields facilitating the exploration and discovery of the real history of a site'.

In Angkor, under the supervision of the ICC, we found large and well-managed restoration sites which were already presented by more expert people than I am yesterday. But it seems that the 'archaeological aspect' is crucially missing.

I have known the ASI and its great scientific expertise for many years. I even had the immense privilege, in 1963, to guide Mr. Amalananda Gosh, ASI General Director, when he visited Angkor. May my Indian friends let me express my regret that no archaeologists work on the Ta Prohm site, by Ta Prohm I mean the City and not only the temple. I am convinced that stratigraphical excavations across the town, on an area which for many years was Buddhist, would expose a multitude of vital data to better understand the temple, which is critical to the establishment of the still hardly- understood history of Buddhism in Angkor. This might also reveal another cemetery of Buddhist statues, similar to the one found in Banteay Kdei by the archaeologists from Sophia University.

I also studied documents sent by the Chinese Safeguarding Angkor team, in charge of the Ta Keo temple, a working site which must be difficult to handle. I noticed that the development of the eastern section of the temple and of the causeway leading to the western dyke of the eastern baray was planned in the project. Nevertheless, excavations were carried out in this area in 1936, which findings seemed to imply that the Royal palace of Jayavarman V could have been located in this area. Therefore an archaeologist should be also working on this site. Stratigraphic excavations would certainly bring positive results for the history of Ta Keo and the period prior to the temple.

I have already talked a lot about my cherished Bayon. I have requested to search under the central massif: I now understand that this request was too difficult (or too expensive) for the team. But I am still convinced that the Bayon 'mystery' will only be cleared up by excavating inside the central massif, not only on the surface, and that eventually answers will be provided on the history of the monument. As for the area surrounding the temple, it probably falls under the research carried out by Jacques Gaucher.

Finally, I would like to add that an ICC for archaeologists, mentioned by Mr. Bouchenaki during the last technical session of the ICC, will become a must when all the teams working in Angkor are assisted by one or several archaeologists on site. This will then be the time to coordinate the teams—is this word not the abbreviation of the third C in ICC?—which will be indispensable for the benefit of Angkor and history. Thank you for your attention.”

**b. Recent research by the MAFKATA Mission (*Mission Franco-Khmère pour l'aménagement du territoire angkorien*), by Mr Christophe Pottier, A/P, EFEO**

“Excellencies,  
Ladies and Gentlemen,  
Dear friends,

Allow me to be as usual brief and even elliptic in reporting on the latest activities of the Mafkata mission. A few liminal words to remind you, if needed, that this mission started almost ten years ago with the study of the development of the Angkor region, regarding Angkor’s older periods, from the “birth of Angkor” to Angkor. It directly affects the first capitals in Angkor before Yaçodharapura’s capital in the late 9<sup>th</sup> century.

Excavation campaigns were carried out on dozens of characteristic sites in the western baray region and Roluos.

In Roluos, the excavations analysed the environment of several characteristic sites:

- Bakong,
- Trapeang Phong,
- Prei Monti,
- Prah Kô.

I have already informed the ICC of the first results of these excavations so I will skip that part. Yet there is something new this year: we did not excavate. Instead, we progressed and in several cases completed several post-excavation studies mainly on the detailed stratigraphic phasing and regarding the study of archaeological articles, especially ceramics.

Simultaneously, additional topographical and GPR surveys allowed us to not lose our tans completely by staying in the offices and laboratories, and also to understand the connections of the excavated sites within their territorial infrastructures.

Besides this, we also completed acquiring K/Ar dating on stratigraphic units representative of the settlement and occupation stages found during excavations. We now have a more comprehensive understanding of the general overview, although may I stress that it is far from being a definite one. Before presenting it, maybe I shall remind our expert audience—who might not be acquainted with all the historical details—some of the known and recognised elements, for example some of the landmark dates given by epigraphy: 900 is usually associated with the relocation of the Haryharalaya town to Yaçodharapura, 802 is the crowning of Jayavarman II and the beginning of the Angkorian era, and 674 is the most ancient date coming from an inscription found in the region of Ak Yum.

Let’s also recall the ornamentation style sequence, which still largely structures the monumental chronology. And I also mentioned the succession—discontinued—of the Khmer kings from Chenla up to Angkor (although making the news lately, I have not included Jayavarman I *bis*). So without bombarding you with dates—I happily admit that I myself do not know them by heart—these can be found in school books, even in books of interest. I here call on Mr. Claude Jacques, as these dates mainly come from one of his books.



[slide] Now that we have set the supposedly known background, here is a selection of more than 25 AMS datings that were obtained by the Mafkata mission for this period. If you understand that the abscissas equal the passing of time and that on the ordinates BKO means Bakong and MTI Prei Monti or AKY AK Yum, then you will notice some discrepancies.

For example the official dating of Bakong from epigraphy is 881 AD, but it is obvious that the installation of the site is a century older. It rather falls in the second half of the 8<sup>th</sup> century, even before the reign of Jayavarman II.

[slide] Another example is the Prei Monti site, where excavations have revealed that it was probably a Palace. It could have been built as early as the second half of the 7<sup>th</sup> century under the reign of Jayavarman I, and one may wonder as to what he was doing in the vicinity of Haryharalaya.

As for Ak Yum, which is hardly known in Angkorian history, it would be a century older, dating back to the first reigns of the Chenla King: what is also troubling is that it could also be nominated for the title of 'first pyramidal temple'.

I am not here talking about other sites for which we shall soon receive other dating. I will not dwell on the new and numerous perspectives and consequences that these elements bring to the understanding of the genesis of Angkor and on its specific role; I will end this part by indicating that we will soon have to upset some of the preconceived notions on the origins of Angkor.

In the same vein, some might remember the prehistoric findings that the Mafkata mission also discovered during the excavations at Prei Khmeng (200-2003) and Koh Ta Meas in the centre of the western baray (2004-2005).

[slide] There again the studies and AMS dating completed this year revealed a solid basis for a vast chronology which dates the occupation of Angkor to some 4,000 years. So we can produce this type of graph, which at least puts the Angkorian events into a longer time perspective.

This enables my transition to the second point that I would like to present to you today. As announced during the previous technical session, our post-excavation research and the conservation treatment of prehistoric artefacts have progressed well, so well that we can convey the findings to the public.

Contrary to the latest sadly developing trend, where everyone thinks it's a good idea to create their own museum to showcase their findings, we have decided to follow the footsteps of what the EFEO has been doing in this country for years, which is to assist and strengthen the existing celebrated cultural and museum institutions. We have then proposed to set up a contemporary exhibition on the topic "Angkor ancestors" in the place which is by far the best and most beautiful museum in Cambodia, the Phnom Penh National Museum.

Gaining the approval and dynamic support of the Director, Mr. Hab Touch, may I greet him here, and of the financial support of Friends of Khmer Culture (FOKCI), Mrs. Latham and the EFEO, then the support of the APSARA Authority and UNESCO, the project started swiftly. The Mafkata mission has then been dedicated since last year a large chunk of its activities to several tasks in preparation for this exhibition.

Firstly, work to complete miscellaneous ongoing studies (anthropological, paleozoological) and to complete some conservatory measures (requiring a lot of care). Then we had to send these fragile artefacts to the capital, even loading a lorry filled with 5m<sup>3</sup> of Angkorian soil in order to rebuild, identically, an excavation square from Koh Ta Meas which is fully equipped with the original artefacts, potsherds and bones included, which were accurately re-positioned based on the surveys of the excavations taken by the archaeologists and anthropologists who took part in the excavation. Also, a specific scenography was cre-

ated, based on the construction of a new set of display cabinets. Then finally the artefacts to illustrate a film documentary in Khmer were added.

[slide] Briefly, as I am going over the five minutes that were allocated, the exhibition is located in the eastern section of the north wing of the museum, at the end of the chronological circuit. It opens up on a 25m<sup>2</sup> restitution of the excavation site of Koh Ta Meas (representing a quarter of the area excavated) which can be crossed via an intentionally rustic footbridge.

[slide] The whole exhibition includes didactic panels in three languages: Khmer, English and French. And the exhibition offers, despite a wealth of information in the texts and legends, a simplified and intentionally educational vision for non-specialist visitors. Once the footbridge and the excavation are crossed, the exhibition offers a series of thematic display cabinets along with panels, all related to complementing subjects, such as: anthropology with paleo-pathologies and DNA, ornaments with explanations about pearls and conservation issues, tools and weapons and how they were used; remains of fauna with a creative restitution of the environment 3,000 years ago. Domestic and funeral ceramics with underneath the different stages of restoration of items often recovered, fragmented in hundreds of potsherds and which restoration is close to a technical miracle, on the same par as the most delicate anastylosis.

After this information and studies, the circuit ends by the restitution of a tomb from Prei Khmeng, illustrating how archaeology can interpret history. Then, in the last distinctive room, onscreen is a film documentary detailing the history of these findings from the Angkor excavations up to their exhibition in the Phnom Penh Museum. As you understand, the goal is outreach to the public, and to disseminate the outcomes of these scientific researches recently carried out in Angkor in collaboration with APSARA, and to modestly illustrate the revival of archaeological works carried out in Cambodia. We hope to raise public awareness of a non-monumental aspect of the archaeological heritage. We have tried to exhibit the method, expertise and professions associated with archaeology and the difficulties they meet, and show the route from the excavation on site to the establishment of a historical knowledge. Favouring the educational side may be to the detriment of the scholarly discourse. We hope that you will identify these ideas when visiting the exhibition and in the trilingual catalogue soon to be published, which will be debated on when, in mid-August, a one-day colloquium on Cambodian prehistory will be held at the Museum.

Let me add that this exhibition was inaugurated on May 6, under the aegis of H.E, Chuch Poeun, Secretary of State at the Ministry of Culture and that it will probably stay there until the early months of 2010 before coming back, if the authorities approve, to Siem Reap and a location still to be disclosed.

I shall finish my intervention by distinguishing clearly what the exhibition owes to the sponsors whose money supported it: FOKCI, Mrs. Latham, EFEO, the APSARA Authority and UNESCO. Yes, money is the sinews of war, but this exhibition is also the result of the work of a team, of many people at EFEO at the Museum and other places. I would like to sincerely thank them without being able to name them personally, in respect of your patience.

I now finish by recalling what Mafkata mission owes to the institutions financing it, in particular the archaeological Commission of the French Ministry of Foreign Affairs and EFEO, as well as the participants, without whom I would not have had a lot to report today. Thank you."

**c. New research in Angkor Thom: first elements for a chronology of the Royal Palace site, by Prof. Jacques Gaucher, archaeologist, EFEO**

"Honourable Deputy Prime Minister,  
Excellencies,  
Ladies and Gentlemen,

From December 2008 until the end of April 2009, the French archaeological mission in Angkor Thom (MAFA) carried out a new archaeological campaign, this time inside the Royal Palace of Angkor Thom. This Palace had previously been researched by EFEO scholars (from J. Commaillé in 1908 to yours truly in 1998, including H. Marchal, M. Glaize, J. Boisselier and B.-Ph. Groslier: the latter carried out the first stratigraphic excavations in Angkor). This time the goal of the campaign was to establish a clear chronology, not of the Royal Palace but of the site of the Royal Palace, hence the title of this paper.

But before talking about the outcomes, I would like to position this campaign within the progress of our research programme. Let me remind you that the aim of this urban archaeology programme does not focus on a single building or location, or a particular period of time. <sup>[slide]</sup> The objective is to gather knowledge on a complex, here of one of the largest and most meaningful capitals in the history of the urban form; for example, here a comparison with 12<sup>th</sup> century Paris. Gathering such knowledge requires specialising, starting with the scale, that of the whole site, which is here monumental. It is then a complicated process, as although Angkor Thom is unique, it is also a city and as with any city, it has a density and a diversity of formal, functional, social and temporal patterns. Also, to acquire such knowledge will take time, as a city, taken as a whole, is neither a tool nor a work of art. It is the result of a multitude of intentions, it has no ultimate aim.

So where do we stand in the programme? The works of the mission proved in the first stage that the forest of Angkor Thom covered the site of a city. The second stage consisted in reporting on the properties of the archaeological site of this city, as shown by the three hundred urban excavations that we searched. <sup>[slide]</sup> The third stage aimed at exposing the spatial patterning of the site: the restitution of the archaeological plan of the city went beyond any scientific expectations. We can nowadays assert that the scientifically planned Angkorian capital was densely occupied for a period and was really the "Great City", as it is called.

We now enter the fourth stage of our work regarding the urban history of Angkor Thom. <sup>[slide]</sup> So is this the plan of one city, or does it inform us on the presence of several cities or formations that successively settled on the same location through time from its creation and this River up to abandonment? In other words what are the great historical evolutions of the Angkorian capital?

On this matter the archaeological plan is a firsthand document; it materially expresses a large section of this history. But when it comes to the representation of the city in its most recent condition, it becomes a cumulative plan where, nowadays, the temporality of its constitutive elements needs to be highlighted. Answers to these questions are dependent on the implementation of three types of archaeological works which have been started. One of these works aims at implementing archaeology of the urban forms of the site, a determining factor on the plan of the city.

This is the background, following the excavations carried out last year in the surrounding walls of Angkor Thom, where an ancient moat was revealed in the south-eastern quarter of the city. This year's campaign focused on a major site, the Royal Palace.

The Royal Palace has a surrounding wall made of laterite, of 540 X 240m, which can be divided from the main eastern entrance pavilion into a succession of four major courtyards. <sup>[slide]</sup> The excavation searched inside the courtyard II, looked over by the Phimeanakas. The excavation area was located 8m south of the southern facade of the Phimeanakas. The excavation works, which faced several expected hindrances, mainly water in this section of the site, reached the natural soil. All architectural structures found during the digging were left on site. This means that natural soil was solely uncovered in the leftover space that was not occupied by those structures.

Excavations revealed a complex stratigraphy and today I will only mention the relative and simplified chronology by showing a diagrammatic section divided into 7 large sections of the site:

- 1 – [slide] Site 7, topographically the highest, corresponds to the last occupation stage of the Palace; probably in the 16<sup>th</sup> century. Made of a laterite paving A which abutted to the Phimeanakas at about mid-height of the lower tier of the pyramid. The original level of the sanctuary was then buried under approximately 2m height. This observation led H. Marchal to proceed between 1916 and 1918 in the clearance of a section of the immediate surroundings of the Phimeanakas, explaining the basin shape that can be seen today on the base of the pyramid. This pavement A was built on top of a 1,20m back-fill B.
- 2 – [slide] Site 6 is at the level C of a horizontal soil which did not correspond to the base of the mountain-temple, covering it at over 80cm height. This is that of King Jayavarman VII, circa 1200, due to the presence at the same level of the stele of the sacred 'Bodhi tree' found by Henri Marchal and located in the south-east corner of the Phimeanakas. The same King probably built a solid wall, shown here in elevation, which borders the south section of the sanctuary, a 13m wide courtyard. This soil, C, dating from Jayavarman VII, also resulted from the construction of a backfill D.
- 3 – [slide] Site 5 presents a different architectural organisation. It was divided into two sections. Located near the Phimeanakas is the peripheral courtyard E of the sanctuary. It measured 9m in width and was built with a brick paving made of three superimposed layers resting on a laterite raft, which thickness is uneven and which might have been the original paving of this courtyard. This triple brick paving is still on site, on both sides of the pyramid. There is also, on its four sides, a canalisation dating after the brick paving and proving that the King's architects had to solve an issue with stagnating water inside this courtyard. The second space is also built. It is made of a platform F made of a backfill which formed a gallery G with laterite moulded base. With this peripheral gallery is associated the south entrance of the Phimeanakas. Some laterite components can be seen on the surface, which ground was located at a level higher than that of the gallery.
  - 4 – [slide] Site 4 appears to be the first stage of site 3. It was also in two sections (courtyard and gallery) but the soil of the gallery was at the same level as courtyard E. The paving of soil H of this first gallery was only made of a single layer of brick, much thicker than the courtyard, which was laid on a raft of laterite I. In both peripheral successive galleries, the border was built in laterite. The structure, constructed with wooden columns, was aligned at regular intervals measuring 60 to 70cm diameters and supported a wooden frame and a tile roof which was restored several times. Several of its components were found in the excavated area. This gallery was largely destroyed: the brick paving was only partially recovered; the lower columns and wall plates buried one metre underground have been recovered, apart from one section. This site 4 can be considered as contemporaneous to or slightly older than the construction of the Phimeanakas. It was once again modified following the construction of a thick backfill K. It was initially made of sand but with the passage of time it weathered, especially due to the action of water.
- 5 – [slide] On site 3, which was recovered by this embankment, was built a large wooden construction L, which foundations were made of long and massive wooden pieces still in very good condition. Its plan was re-interpreted in the whole excavated area. It is a crowfooted plan. It is gridded and detailed measured drawings will give an indication of the assembly techniques. The plan of this massive wooden building and its location were prior, but slightly offset, of those of the laterite gallery previously mentioned and located almost two metres higher.

- 6 – [slide] The foundations of this construction were built on an already constructed area on the upper section of a previous development which history started 80cm lower and which are at the origin of the configuration of site 2. On horizontal soil N, where water was found, a hydraulic infrastructure was built. It is outlined by the construction of a clay dyke M, facing north/south and which bordered two areas: to the east and right, a series of backfills forming a platform; to the west a canalisation or a water body which was filled by layers of clay filled with microparticles of charcoal and pieces of cut branches. This development was recovered by the soil where the wooden construction was built.
- 7 – [slide] This pattern and its fillings were not the first occupation of this location, as a new site 1 appeared in the form of a perfectly horizontal and extremely melanised soil O. This soil had two characteristics: it contained extremely well preserved fruit stones which kernels had been chewed by rodents (squirrels or rats); 2) It showed in one specific location a slight colour difference and had a specific sound. In this location from the soil, the excavation uncovered the well- preserved trunk of the tree P, measuring 50cm in diameter. This isolated trunk was horizontal. It was buried approximately in the north/south direction from the soil, where it probably bore fruits at some 60cm higher.
- 8 – [slide] The excavation then uncovered the natural soil Q and to a lower horizontal level, traces R of a natural process which stopped the transformation of this ground.

This inventory raised several questions on different specialities that can be linked with information gathered during our previous excavations. I will here list only five points:

1. The site of the Royal palace of Angkor Thom shows traces of a succession of occupations and transformations, forming a complex archaeological stratification of five metres high. It is beside the earth levies, the maximum deposit inside the capital. The goal which was set has been reached. The conditions for an absolute chronology shall be proposed for the future. We shall wait for the datings, now possible, from the several vegetal components collected during this excavation.
2. It is in this context, circa 1200, that the capital was deeply transformed. Chronologically it constitutes the sixth occupation of the site.
3. The building of the Phimeanakas occurred on a site with a long history.
4. The construction of a wooden monumental building raises questions on the existence of a site which was most likely a large monastery and/or a first Royal Palace.
5. I would now stress the exceptional situation of the Palace and of the Citadel surrounding it. The first occupation of the site of the Royal Palace, illustrated by the presence of, at a depth of five metres, fruit stones and of a buried horizontal tree trunk raises several questions: (1) how can the analysis of this site open up new scientific prospects in terms of dendrochronology and even of climatology? (2) Which type? (3) How old is it? (4) Finally, why was a tree buried on the original site of the Royal Palace?

Regarding this last point and far from any technical questions, let's leave aside the excavation of the soil to climb up to the top of the Phimeanakas. It is in this same place that people living in Angkor Thom told Zhou Da Guan that each night, in order to maintain the stability of the Kingdom, the King embraced a nagi which took off its snake skin to turn into a woman. A similar story, both more famous *and* the legend of the foundation of the Khmer Kingdom, also tells of the presence of a nagi and of its union with Brah Thon the August, a story which is still part of Cambodian wedding rituals. But the Khmer specificity of this founding legend of Cambodia is not the fact that an Indian prince met and wed the daughter of a naga King—this type of wedding is actually pretty common in the history of Hinduisation—but that one of the central characters of this episode is, in reality, a tree called *thlok* or, scientifically, *Parinae amarensis*. And it is on this tree, this is a quote

from the foundation legend as it was reported in the Royal Chronicles: 'at the place of the tree *thlok* arose an august and excellent Palace...' other points could give a historical truth to the legend. This is only a hypothesis that I have to share with you. But the time is not for another wedding uniting soil stratification and a founding myth. It is now the time for identification and scientific dating of these new archaeological components: experts in each field are now working on this. Thank you for your attention."

*Comments from the Co-chairman for France:* "these are questions which deserve further research. I now give the floor to Mr. Eric Bourdonneau, speaking on the white elephant of Koh Ker. I would like to add that works carried out by Mr. Bourdonneau on Koh Ker have been implemented with the authorisation of the APSARA Authority and that they will be reported in the coming months. Thank you very much".

#### **d. Phno Damrei Sâ (Tomb of the white elephant) at Koh Ker, by Mr. Eric Bourdonneau, Archaeologist, EFEO**

"Excellencies,  
Honourable Co-chairman,  
Honourable colleagues,

[slide] Phno Darei Sa, 'the tomb of the white Elephant' is a small hill located near Prasat Thom of the Koh Ker archaeological complex, 80km to the north-east of Angkor. The existing site of Koh Ker is located on the ancient city of Chok Gargyar, an ephemeral capital created by King Jayavarman IV. He settled there in 921, abandoning Yaśodharapura-Angkor, where the two sons of Yaśovarman continued to reign for some years.

[slide] The actual excavation programme on the hill of Phno Damrei Sâ aims at better understanding the organisation of the ritual complex formed by Prasat Thom and furthermore, to understand the landmark that the reign of Jayavarman IV seemed to have been in the history of ritual practices in ancient Cambodia and of representations related to these practices.

Different traces give effect to this landmark. One of the most remarkable might be the mention in inscriptions of the Prasat Thom of the cult of Vrah Kamrate Añ Jagat ta Rājya, the Kamrate Jagat ta Rāja or, in Sanskrit, Devarāja of later inscriptions. It is the oldest mention of this cult within the epigraphic corpus of the Khmer country.

Also noticeable are the first specificities of the architectural layout with a developing and new centralised plan. We will mention later the iconographic innovations characterising the temple. All of these specificities are included in a research study carried out in Phnom Penh within the framework of an EFEO global research programme on holy places of ancient Cambodia.

Adding to these characteristics of the Prasat Thom, is the Phno Damrei Sâ. Its close proximity to the west of the temple and in the continuity of its axis, its profile and dimensions, which are similar to the pyramid, suggest strongly that it is a component of the ritual complex formed by the Prasat Thom. But we have to make sure that it was one of the main objectives of this first diagnosis campaign.

Once the area of the Phno Damrei Sa was confirmed as cleared of mines, the work on site started in mid-March and lasted until Khmer New Year in mid-April. The team included four archaeologists, French and Khmer, a topographer and 30 to 50 workers.

Prior to the start of the excavations a ritual ceremony was organised to honour the spirit of the Damrei Sâ, attended by HE Mr. Seung Kong. The hill is presently a 'living' place, which means a holy site still in activity and a place for pilgrimage and offerings.

Following a traditional methodology the first task was to carry out the topographical survey of the hill and to create a digital model. This survey provided some interesting information as existing documentation was not sufficiently detailed. The hill is almost a 100m in diameter. Its centre of gravity with relation to the axis of the Prasat Thom is slightly off-set from north to west (of around 15m). It culminates at 22m from the surrounding ground level.

[slide] It has a remarkable geometrical form on plan and elevation. Its west side is a straight layout, almost facing north-south. The gradient is important (up to 35°) and is bordered by two clear arêtes leading to the top. The eastern side is curvier, in the shape of an arc of a circle and has a smoother gradient. The little information we had before starting the campaign made the likeliness of a natural hill rather impossible. The topographical survey indicated early on in the campaign that it was impossible and the excavation confirmed it.

[slide] The pits were located according to information given by the topography and in order to collect as much information as possible within a limited diagnosis campaign. Three test pits were excavated: a 25m trench on the western side of the hill, on a south-east/northwest axis; a 10m trench opened across the axis of the south-east arête of the hill; and finally a 80m trench to the east, across the axis of the pyramid and of the surrounding wall of the prasat and reaching the top of the hill. Each trench was 1.5 m wide. The largest one was temporarily widened by 1.5m whilst the excavation was progressing: at the bottom of the hill, two large hip knobs blocked the trench at the foot of the surrounding wall. At the top an alignment of sandstone blocks was difficult to read on the initial width of the test-pit. The total length of searched trenches reached 115m.

[slide] The test-pits located on the hill sides were searched 'in terrace'. The depth of these levels was of circa 1.5m in their lower section and of 3m in their upper section. In two locations, the depth of the level searched reached 5m in its upper section: to the foot of the eastern side and in the upper test-pit of the western trench. Both locations justified these excavations so that questions raised by analysing the stratigraphy could be answered.

Where the gradient is the most remarkable, we built vegetal barriers made of bags of soil and branches in order to hold the rubble from the pits. Similar protections were erected in the axis of the trench to ensure safety for the workers operating beneath other workers. We also let some berms so that they serve as protection when refilling. Once the excavations were finished, 'walls' of soil bags were erected at the bottom of the pits, in order to efficiently hold the backfilled soil in the most graded sections.

[slide] Once we were certain that this hill was man-made and not natural, two main objectives were set for this first campaign:

- to understand the stratigraphic relation between the hill and the built-up areas of the Prasat Thom, the pyramid and the surrounding wall.
- To try to date the hill, knowing that the construction of the mountain-temple dates from Jayavarman IV.
- To understand the structure of the hill, at least of the sub-surface, and to gather first traces on function, thereby the rationale behind its construction.

[slide] The excavation brought some decisive information on the first point. Interesting is the level of the ground associated with the surrounding wall of the pyramid but I won't go into too much detail. This ground level is made of an indurated laterite layer. The excavation clearly exposed that the heap of sandstone blocks delimiting the western facade of the hill (and part of its structure, see *infra*) is directly resting on the laterite ground related to the surrounding wall. In other words, it means that the construction of the hill is likely contemporaneous to that of the pyramid. The word 'likely' means that it might have been built a few months or years after the pyramid, but probably not later.

The excavation also uncovered a level of occupation prior to the construction of the temple and its surrounding wall. Abounding with charcoal, animal bones and pottery crushed on site, it can be interpreted as the bottom of a pit into which kitchen waste was thrown, close to a residence. The lower layers of this bottom correspond to the level of the virgin soil.

As for the composition, several questions remain to be answered but many have been explained. <sup>[slide]</sup> We have already mentioned an alignment of sandstone blocks at the foot of the hill. This alignment on both sides of the trench is of 5.5m width. No other blocks of similar dimensions can be seen on the surface of the other sides of the hill. All that can be said today of this alignment is that it clearly delineates the area of the eastern facade of the Phno Damrei Sâ. Noticeable is that this alignment is found again but with smaller size fieldstones at the top of the hill, also facing north-south.

<sup>[slide]</sup> The structure of the hill as understood presently is relatively complex. It is formed on its sub-surface of a succession of extremely compact layers of mixed laterite, clay and sandstone fragments. The profiles of these backfill layers follow the gradient. Where the gradient is low, the hill elevation is made of an accumulation of firstly horizontal layers, then layers which are more inclined. <sup>[slide]</sup> This accumulation is interrupted regularly by alternating clay and laterite beds with beds of sandstone fragments. In the places where the gradient is at a maximum, the elevation of the hill is composed of a succession of strictly horizontal layers. This all makes up for a solidly built hill. The structure of the hill clearly indicates that it was built to last. Its profile has not changed for a millennium. The thickness of the layers that could be interpreted as colluvia is scarce when compared with the hill's dimensions.

<sup>[slide]</sup> In two test-pits at the top of the western hill, the compacted layers that we mentioned give way at circa 1.5m of depth to a layer of a different nature. <sup>[slide]</sup> Less compact, they are made up of a bed of ashes containing a lot of charcoal mixed with sand and sandstone blades. Alternating with bed of ashes are clay beds or laterite beds structuring the layer. A strong dip also distinguishes them from those at the upper level.

<sup>[slide]</sup> To summarise, this appears to be a sample of the internal structure of the hill, whereas the external structure is made of more compacted backfills. Where does this charcoal come from and why such a layer in the middle of the hill? Moreover, knowledge on ancient ritual practices of ancient Cambodia is not sufficient to give a certified answer. In this context, that this was a funeral pyre springs first to mind. At this stage of the works, we need to remain cautious. Firstly, because the excavation documented a small area of the structure of the hill and at a limited depth compared to its 22m.

This takes me to the mission's next stages. Priority is given to better document this layer of ash: better knowledge of its depth, profile and extension is necessary. With regard to the volume of the hill, other methods than test-pits must be implemented. We then plan to start using careful coring. At the same time, new test-pits of smaller dimension are still planned. This would help provide a better understanding of specific sandstone alignments located at the foot and top of the hill.

Finally, I would like to present a study carried out during this first campaign, besides the excavation works and authorised by APSARA: the measured drawing of the paving of the eastern entrance pavilion II of the Prasat Thom.

This gopura, as is the case for the western entrance pavilion II, originally sheltered an exceptional complex of sculptures in the round. These statues regrettably suffered from looting and their fragments have often been moved since the first site descriptions of Louis Delaporte. Within the framework of the iconography of the temple, the main objective of this measured drawing was to locate the traces on the ground of the original locations of the statues. In particular the aim was to determine if locations were planned for eight statues (according to Delaporte's descriptions) or for six statues (according to Parmentier). The measurements clearly proved that it was six.



In collaborating with the restoration workshop of the Phnom Penh National Museum, this measured drawing work was an opportunity to start an inventory of the fragments of sculptures found in the gopura. Some interesting discoveries were found. Notably, fragments of the horn and the head of the bovid which visitors pass by daily.

This head does much to symbolise the status of Koh Ker within the Khmer archaeology. It is a symbol because the site might be full of surprises. Thus, this head which was always thought to be that of a bull, mounted by Shiva, is in reality of a buffalo, mounted by Yama, King of the dead. The latter accompanied by Dharma and Citragupta, the two famous assessors of Yama.

This head also represents the great originality which is the overall characteristic of Koh Ker. Representing Yama as judge and King of the dead, and not only as the divinity guarding the South, is exceptional in the Khmer iconography. There is a famous image of Yama in the gallery of the inferno in Angkor Vat, but it is a bas-relief to which the sculpture in the round of Koh Ker is a distant ancestor.

Excellencies, Ladies and gentlemen, honourable colleagues, I thank you for your attention and warmly thank the APSARA Authority for assisting me on the site”.

**e. Archaeological Program at Phnom Kulen, operations in 2009, by His Excellency Ros Borath, Deputy General Director, National APSARA Authority, and Mr. Jean-Baptiste Chevance, Archaeology & Development Foundation**

**Mr. Ros Borath:**

“Excellencies,  
Honourable Co-chairmen,  
Ladies and Gentlemen,

May I start by recalling the administrative and financial background of this programme:

- The Archaeology & Development foundation is a Charity company, validated by the United Kingdom Charity Commission.
- This body finances the *Safeguarding Programme of the archaeological heritage of Phnom Kulen*.
- Funding is exclusively private. It allows for planning from 2008 until 2010, with work on site during the dry season. We are half-way into the second and penultimate year of the programme. The institutional framework of the project is managed by a convention signed on January 3, 2008, between the Archaeology & Development Foundation and the APSARA Authority.
- The contribution of the APSARA National Authority to this programme as partner of this programme is the following:
  1. Outsourcing archaeologists
  2. To set up a maintenance team composed of ten individuals.
  3. To put up emergency propping,
  4. A partnership with the governmental agency CMAC to clear landmines from the site.

This project stems from several assessments:

1. Mr. Chevance who is in charge of the programme, reminded us last year that Phnom Kulen is a unique geological, topographic, vegetal and archaeological complex in the Angkor region.
2. The archaeological sites of the Phnom Kulen are distributed throughout the

whole of the mountain massif (circa 30 x 10km). They are numerous and diverse: around 30 temples, dykes and ponds, equipped caves with bas-reliefs, a sculpted river, ceramic kilns etc.

3. 8 mostly isolated villages are located on the plateau.
4. Until the establishment of this programme, these sites were not protected nor maintained. They were looted and the presence of mines and UXOs make it a difficult site to reach.
5. Also, despite the major role they play in the understanding of Angkorian history, these archaeological sites remain largely unknown.

The programme is articulated around three major axes:

Firstly, the conservation of the sites through archaeological research:

- The safeguarding of the Phnom Kulen heritage includes the implementation of archaeological research, which is vital for better knowledge and conservation of these sites.
- The number and variety of the archaeological sites of the Phnom Kulen requires selecting intervention sites each year of the programme, depending on their value and necessary conservation measures.
- The methodology set up for archaeological research was translated in the field by carrying out topographical surveys and test-pits.
  1. The prospections complement the archaeological map.
  2. The test-pits and topographical surveys detail the nature and scope of the major sites.
  3. They also:
    1. Precise the occupation dates of each site.
    2. Determine the protected zones.
    3. Set up emergency conservation measures, in close collaboration with the APSARA National Authority, for the monuments in danger of collapsing or for carved fragments requiring restoration.

The objective is that in 2010, the complex of the archaeological site of the Phnom Kulen will be managed by the APSARA National Authority, thereby extending the scope of its activities in the Angkor region.”

### **Mr. Jean Baptiste Chevance:**

“Excellencies,  
Honourable Co-Chairmen,

It is an honour to report on the excavation works carried out in 2008-2009, following approval from the APSARA National Authority on December 24, 2008. Our team worked on six sites on the Phnom Kulen.

### **Prasat Krol Romeas**

<sup>[slide]</sup> This temple is located on both sides of the river, upstream from the waterfall. Visitors come in plenty to the site at week-ends and festival days; they impact directly on its conservation. The site is stressed by unmanaged mass tourism. Picnic huts have been erected in the precinct of the monument and there are no existing protection measures.

Following a visit from officials of the APSARA National Authority and ICC experts in late November 2008, one of the plenary session's recommendations underlined the need to prepare a master plan 'to be submitted to the next technical session'.

[slide] The topographic survey of this area was a first priority for our team. It includes, in red on this plan, the consequences of recent impacts. As for the survey of the thousand lingas site, this was postponed until 2010.

This survey of the approach area will enable the APSARA National Authority to set up a master development plan and to put forward protection measures. The Authority can contact us for any assistance on setting up the master plan.

On the other hand, the Prasat Krol Romeas is the only monument attributed to the Jayavarman VII period on the Phnom Kulen massif. Its location on both sides of the river and the layout of its buildings make it a unique temple. Therefore the survey will partly bring answers to the questions raised by the peculiar architectural form of this monument.

### **Prasat Thma Dap**

[slide] The second site excavated is number 6 on this map: *Prasat Thma Dap* where test-pits were carried out in 2008. The aim was to determine the nature and footprint of the main structures and to date them.

A series of interventions, also for conservation, *have* been carried out: a clearing of the upper part of the tower, and the APSARA National Authority built a prop on the northern half of the western side.

In 2009, a second prop was planned by the APSARA Authority inside the tower. Before installation it was necessary to excavate the rubble from looting to set it directly on the paving. Measured drawings were also completed and observations of the foundation system of the main tower made.

[slide] Excavation of the still un-looted foundation shaft and the resetting of the pedestal at the centre of the sanctuary were only carried out for safety reasons after construction of the propping.

The APSARA Stone Conservation Unit and members of the GACP then started work on the previously looted pedestal and on the doorframe of the sanctuary.

### **Poeng Tbal**

[slide] The third site where we intervened is the Poeng Tbal cave. This is the first time that a rupestral site of the Angkorian period has been studied in Cambodia. Bas-reliefs and inscriptions enable characterisation of the site but an archaeological intervention, including test-pits and measured drawings, helped us understand its stratigraphy, gather archaeological material and finalise the topographical data.

Mine clearance and a first topographical survey were carried out in 2008; in 2009 five test-pits located under and below this rock shelter were dug. An important quantity of ceramics and tiles were found in some test-pits; this material is being analysed. The research has already revealed a variety and abundance of materials which contrast with the usual representation of the habitat of a hermit.

The ceramics and the inscriptions seem to point towards a 10<sup>th</sup> to 12<sup>th</sup> century occupation of the site. Additional measured drawings recorded several traces of development (postholes, carving traces, coring...). [slide] They are evidence of a now vanished wooden architecture, represented in green and pink on this map.

Finally, the last prospections uncovered the traces of several similar developments on top of the surrounding rocks, which make us believe that this habitat might have developed beyond this rock shelter. The Poeng Tbal site must be considered not only as more important than a simple hermit shelter; the exact function of these developments requires further research by completing the overall plan and carrying out further test pits in 2010. [slide] The tumbled pedestal under the main arch was put straight and the yoni/linga monolith that had been thrown away broken into two pieces was also reset on site. The Stone Conservation Unit, assisted by GACP members, consolidated this pedestal and joined the two fragments. Bas-reliefs with cracks were consolidated. Some of them had been looted.

### **Prasat Rong Chen**

Prasat Rong Chen is where we worked the most this year. It is located on one of the highest points of the plateau and is the only mountain-temple of the Phnom Kulen. Roughly located at the centre of the temple complex of the massif, it was considered as the religious centre of the presumed capital of Jayavarman II.

This temple was until now considered as an architectural prototype of this type of monument. It is also the only monument on the Phnom to be built with massive laterite blocks. The site was cleared of mines in 2008 and a topographical survey carried out once 1.5ha had been cleared.

[slide] Here, a view of the monument in the 1970s, and a picture from January 2008. In 2009, 23 test-pits were opened on the different storeys of the temple, on the ramps and where topographical anomalies on the second storey were noticed. They represent an area of 1,300m<sup>2</sup> and mobilised more than 120 workers. The archaeological works carried out (topographical survey and diagnosis test-pits) determined the large dimensions and the method of construction. The C14 and ceramics analysis will clarify construction and occupation dating.

An architectural and archaeological analysis of this mountain-temple can already be done. It was built with five levels, each with a square plan covering an overall area of 4.5ha and of a height of more than 16m. The architects adapted to the natural topography and transformed it. They built the first two levels by backfilling the northern section whereas the southern section is made of levelled and cut sandstone slabs. The second level, formerly considered the first of the temple, measures 103m width x 2m height. The discovery of a first level measuring 210m width x 6m height considerably 'enlarged' the monument. The southern section of this first level, which is still not cleared of mines, needs to be studied. [slide] The three upper levels are built with laterite blocks located on the panorama at the top of the picture. The third narrow level revealed uncut and uncompleted blocks. The fifth level includes in its masonry, at the bottom of the picture, a brick casing of 5m width x 3m thickness. This brick casing is covered by two side laterite courses, heavily damaged after looting. The central section of these two courses must have been the support of the sandstone pedestal.

[slide] Quarries were also uncovered all around the temple on the first level. Similar to those already known on the south-east corner, they were probably used to extract the blocks of sandstone necessary for the first and second levels. The backfills on the top left of the picture are made of successive layers of laterite gravels staggered with sandstone blocks of large thickness. Also, trenches opened on the access ramps, between the third and fifth levels to the east and west of the monument, show that these were structures never before seen in Khmer architecture. These ramps rested on the last level of the temple and were built during its construction. They are traces of the temple construction not being completed, or rather, stopped.

The test-pits also uncovered six annexes on the second and third levels of the temple. Some of them are made of laterite walls with tile roofing, others were covered with vegetal material. Others were built on wooden posts, resting on blocks made of laterite.

Moreover, a covered gallery on the third level, a sacred deposit, a pedestal and a linga on the fifth suggest that this temple was consecrated and used.

[slide] We also carried out photographic recordings and topographical survey of the upper level of the temple. The postholes and raglets on the paving showed that three wooden constructions coped the last level of the temple. Prasat Rong Chen is then a unique example of a mountain-temple which construction was stopped, but was itself used.

[slide] A conservation project was implemented with the APSARA Authority for the fifth level of the temple. A hole was dug in the brick masonry where Mr. Dupont of the EFEO excavated in 1937. It was dug further by looters afterwards, deteriorating this upper level. It was then decided to fill this looting hole with laterite blocks, to reset the cruciform stones discovered in 1937 after restoration and to fill the holes in the brick masonry using compacted sand.

This indicates that as much as possible we will try to leave archaeological items on site and if possible in their original location. In this particular case, as stones were reburied this will also ensure their conservation. These sandstones had been left on the site since 1937 and were consequently looted. These stones and the way they are stacked together is the only known example of this type of deposit. Restoration of these stones was carried out by the Conservation Stone Unit and GACP members. They were then reset on location. In 2010, two new blocks of laterite courses will fill the missing parts caused by looting. The pedestal and the secret deposit stone which were turned over and looted before 1938 will be returned to the centre of the monument.

### **Prasat O Paong**

[slide] Works was done on the Prasat O Paong: five test-pits were opened near the tower, the platform, the surrounding wall and in the presumed locations of a gopura and of a possible 'library'.

The gopura and the library do not present any construction traces. The trenches revealed the traditional use of a foundation coffer: the general embankment of the site, distributed on a sandstone slab, was re-dug to set up this coffer and the surrounding wall. The eastern section of the site was strongly backfilled to compensate for the natural pitch of the sandstone.

[slide] The clearing inside the tower helped in understanding its method of construction. In terms of conservation, here is a north-south section of the overall site; the facades of the tower are higher than 20m and were completely cleared. The fig tree growing on the western and southern side was cut into pieces. The second flight of stairs had been entirely dismantled during recent looting. Thanks to archive documentations we were able to reassemble this flight of sandstone steps as per original.

Two emergency temporary props were built to prevent any imminent falls. The first one is located on the southern doorjamb of the sanctuary. The second prop is located on the second level and supports the building of the north-west corner of the third level.

This was flagged to the team of architects of the APSARA Authority. A restoration project is being drafted. The Stone Conservation Unit also worked on the Prasat O Paong for the conservation of sandstone components: the doorjamb and small round columns.

These elements of architectural decor were left on site. As there are no guards yet on the premises, a wooden shelter was built to prevent any malicious intent. This is obviously a temporary solution until the start of the restoration programme.

### **Banteay**

The last site we worked on is Banteay. It was located in the 1960s and was already known by the villagers, but hardly studied. Prospections carried out in recent years revealed some developments but could not lead to a proper understanding of the site.

Mines were firstly cleared on the dykes to determine the edges. The topographical surveys revealed that the temple is a 600 x 400m quadrangle covering an area larger than 24ha, rather around 30ha. We did not have sufficient time to clear the site of mines or to map it; this will be done next year. Rather, we focused on clearing the mines in the archaeological operation areas at the centre of this quadrangle, which enabled us to partially locate and map several berms.

[slide] To the centre-west of Banteay, a berm of approximately 50m length showed a large quantity of bricks on the surface. Several test-pits were excavated, revealing a specific plan, unknown in Khmer architecture. It is a construction on a square plan which from the centre to the outside is paved with a cavity wall with an inner backfill, a second paved area, then another cavity wall surrounds the space. The outer wall of this latter is moulded and shows an axis crowstep with stairs and string walls on the eastern side. [slide] A later addition extended this construction on its northern section with the same cavity wall system. Here are some examples of the moulded wall or of the paving.

The location of this berm inside the Banteay site, surrounded by huge dykes, and the precision of this brick building suggest that it was a building with special functions, maybe used as a palace in the heart of a city. The ceramics collected from the test-pits suggest a pre-Angkorian context still to be confirmed by further studies. It could then be one of the oldest settlements located on the Phnom Kulen. It is too early to state whether it is the City where Jayavarman II settled. But the major developments and the concentration of structures show that it is a major site, probably that of a capital. There will be further research in 2010.

We also will carry out a series of coring on ponds and water bodies in the Phnom Kulen in June 2009, in collaboration with the University of Sydney. This will give us an overview of the paleobotanical environment of the Phnom and eventually a dating of these hydraulic structures.

The two other objectives of the Phnom Kulen archaeological programme are to train young Cambodian technicians and to contribute to local development:

- this programme seasonally employed 120 workers, coming from four different villages, from the end of December 2008 until mid-May 2009.
- The programme contributed to the full time employment by the APSARA National Authority from June 1, 2008 of ten workers in charge of the maintenance of the sites cleared of mines and researched.
- Mine clearance operations have secured 7ha since the onset of the programme.
- CMAC teams have also neutralised in the villages several UXOs which presence were known by the villagers.

Regarding health, medical support is included by financing a full time nurse in the Health centre of Anlong Thom village, the only one on the plateau, for a population of 4,000 individuals. Medical equipment and medicines are also supplied to the centre. Previously the nurse only came three times a month. Two bridges were also financed in the infrastructure field of the programme, one to prevent villages located to the south of the Phnom Kulen to be cut off from the outside world in the rainy season.

A&D Foundation would also like to support villagers in the education field. The restoration of a primary school is planned and so is the building of the first grammar school on the Phnom Kulen.

Regarding training of Cambodian professionals:

- The programme hired two full time archaeologists.
- It also contributed this year to continuing the training of three archaeologists from the APSARA National Authority.
- The training programme with the Archaeology faculty of the Royal University of Fine-Arts continues. It offers in the field and post-excavation training to 15 students per year.
- The last item concerns three students whose ends of the year dissertations present topics from the Phnom Kulen Archaeological Programme.

I now give the floor back to HE Ros Borath about the perspectives and challenges awaiting the project. Thank you for your attention."

**Mr. Ros Borath:**

"This is the penultimate year of this partnership programme between the APSARA National Authority and the Archaeology and Development Foundation.

- In late 2010, the archaeological sites of the Phnom kulen shall benefit from an overall management from the APSARA Authority, extending its scope of activity in the Angkor region.
- At the end of this programme, a dozen sites will have been studied, providing a wealth of information for archaeological research in Angkor.
- These sites will be maintained after mine clearance is completed. Other sites should also benefit from conservation measures or at least from regular maintenance.
- It is then vital to implement a mine clearance programme on a large scale so that maintenance can be carried out on these sites. To this effect, the Phnom Kulen Archaeological Programme team will soon submit to the APSARA National Authority and the CMAC Agency a programme.
- This mine clearance programme includes hiring a team of guards and strengthening the APSARA Authority's maintenance team, who are to be equipped adequately. This management shall translate into hiring a conservator in charge of these sites.
- Recent lootings at Prasat Khlah Khmum and the presence of armed buyers looking for sculptures and informed of the 2008 discoveries prove the threats still hanging over these remote sites.
- The emergency restoration projects at Prasat O Paong, Prasat Rong Chen and Prasat Neak Ta still need to be implemented, as does the redevelopment of the approach areas of Prasat Krol Romeas. These works should be carried out before completion of the Phnom Kulen archaeological programme in late 2010.
- I also would like to remind you that the Phnom Kulen is a National Park. Nevertheless, deforestation of the foothills and of the plateau is still ongoing, and no protection measures have been taken. These archaeological sites are within a unique natural landscape. It is then vital to set up protection zones around each of them to stop deforestation, by then preserving the authenticity of the sites.
- This general protection could meet the criteria to add this site to the World Heritage List of UNESCO. Thank you for your attention".

Comments from the Co-chairman for France: "this paper introduced some aspects concerning development showing the difficulty to dissociate these points. I now open the floor for discussions on all of the presentations you have just heard."

## **GENERAL DISCUSSION**

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Comment from Mr. Bouchenaki: "firstly, I would like to congratulate all the experts who presented the full activities of the archaeological research. I think that we are at the heart

of one of the issues regarding the understanding of the Angkor site and the papers presented this morning, starting from Professor Claude Jacques liminal presentation to Messrs. Ros Borath and Chevance, showed us how archaeology is today a major component in knowing the whole of the Angkor site, and not only its central section inscribed on the World Heritage List. The second element is to make sure that all these data shall be gathered and compared. This was shown yesterday with the research carried out in the heart of the temples which bridge the different archaeological researches and help to determine occupation levels and dating. I believe that the archaeological field is rather complex and you noticed, in particular with Mr. Pottier's paper, how hard it is to still establish an accurate chronology. This is an assessment and I think that it is of importance for the technical committee to stress the place given by the APSARA Authority to archaeology and also to notify what archaeology brings in terms of dissemination of the historical knowledge of this site, especially with the exhibition at the Phnom Penh National Museum. The question now being asked is that when one excavates one destroys, so how do we manage these pits? I believe that Mr. Gaucher presented remarkable discoveries with a stratigraphy reaching five to six metres depth. So here is a question to Mr. Gaucher and others: How can you imagine presenting your archaeological findings and their contribution to the overall knowledge? I think that one should backfill as the legibility of the land remains very difficult even for experts."

Comment from Mr. Fletcher: <sup>[OrigE]</sup> "I would like to make a comment regarding the evidence for organic materials for the archaeological site in Angkor. I was very impressed that Professor Gaucher found very well preserved organic materials in the lower layers of his site, the same goes for M. Pottier on the elephant terrace and for our work in the great canal of Angkor; we are finding well preserved materials at the bottom of the canals. And this is somewhat contrary to an expectation of the preservation of organic materials, particularly in a tropical environment. The point I want to make particularly to non-archaeological specialist is that this information is absolutely critical as a resource for understanding the history of the environment of the Angkor region, the impact of the urban area on that region and also for dating the occupation patterns and changes to the landscape. This organic material, which is sometimes buried in very ordinary locations like the bottom of an empty canal, is a critical information resource for understanding the history of Angkor."

Comment from Mr. Beschaouch: "I start by congratulating Professor Claude Jacques who convincingly and for several years has never ceased to draw attention to the importance of archaeology. The examples given have shown that his discourse was relevant and that it must continue. To show that archaeology is not only for those who work on it such as examples shown by Professor Pottier or Gaucher for France and also by the Japanese teams, but that it has its say. I would like to quote again Mr. Ishimura Tomo, as mentioned by Mr. Claude Jacques: 'archaeology and restoration are two parallel fields facilitating the exploration and discovery of the real history of a site'. I would rather say: 'archaeology and restoration are two complementing fields facilitating the exploration and discovery of the real history of a site'. As I think that it is not parallel but complementary and this was shown through many examples. Let us not forget the past to establish the truth. Archaeology was practised by foregoers like Groslier and Marchal. Every time I hear or read an article on archaeology, it has been going on for a long time. I remember my first archaeology lecture at the *École Pratique des Hautes Études* in 1963. 45 years ago then, the lamented Paul Courbin was my lecturer and he worked here in Angkor. And for six months he talked about his excavation in Sra Srang. He was one of the first with Sir Mortimer Wheeler to practise stratigraphic archaeology and especially small squares. So this has been going on for 40, 50 years. One needs to insist on this and remain modest. As such, discoveries such as Mr. Gaucher's are extraordinary: he set out the spatial organisation of this town coming from the Indian texts whereas Mr. Bouchenaki and I come from the roman world where there is a town called Tinga which is almost a copy of Angkor laid out on an orthogonal grid. So let's pay tribute to the EFEO which, when it ran the Angkor Conservancy, still carried out archaeological works. This is what I wanted to add, whilst congratulating our friends for the huge works carried out and the attendant scientific and methodological progress. Mr. Sahai would like to take the floor. Let me introduce him, he is an epigraphist and an historian who, thankfully, was invited by HE Sok An the Deputy



Prime Minister to advise the APSARA National Authority and National Authority for Preah Vihear. For almost a year he has been the scientific adviser of both bodies.”

*Comment from Prof. Sahai:* <sup>[OrigE]</sup> “thank you for your introduction. I feel it is some sort of an obligation on my part to intervene on the work of the EFEO. As an old associate of the EFEO, I started working with George Coedes; I remember all the directors of the EFEO. For the past five years I have been following the research conducted by the EFEO and I find most of the research and archaeological projects very conducive, and I am very satisfied that they are following the great tradition of the EFEO. And I would like to point out two projects: one on Roluou and the other on Ankor Thom that are of great consequence. Because for the last one hundred years we have been thinking that these two areas are accumulations of temples, but now excavations are showing rightly that inside Angkor Thom, ordinary people lived. The falsified image of Angkor as the kingdom or city of despots is going to be washed out because with the Kings lived many ordinary people and it is thanks to these two great projects that we have knowledge of this. What I would like to add and emphasise is that it is true that all of us are experts, and that we rule out all that is beyond the comprehension of the masses, but it is not true to a great extent if you communicate it to the public and we are working on this. Therefore, I would like to make a recommendation to the government of France, which bears a lot of responsibility for Cambodia. And on this matter I have been talking with Jacques Gaucher for the past four years. All current and future excavations should be displayed in some part of the city of Angkor Thom as the Angkor Thom City information centre, and it should be fully financed by the government of France, because this is going to be one of the major results of these excavations and because we have to serve the people at large. So please don't cover everything. I would like to thank our friend working at Phnom Kulen, he has found eight crosses, and then he has filled it up. But he did not bury the knowledge. Now everyone is querying the meaning of these eight crosses and Claude Jacques, one of our great Sanskrit scholars, will be applying his knowledge to understand this. Thank you very much.”

*Comment from the Co-chairman for France:* “thank you Professor for this intervention and appeal. I would like to go back to the remark made by professor Bouchenaki regarding excavations. He asked a question and requires answers”.

*Answer from Mr. Gaucher:* “Mr. Co-chairman, I would like to take the floor to answer to Mr. Bouchnaki. His question is extremely important as we always talk about monument conservation, which means of their elevated structures, and we rarely talk about their buried structures. It is an important and complicated question. I would, based on my experience, divide this question in two parts: the first regarding the shallow or uncovered structures. In that case, it is simple to exhibit them with additional financing which usually is not included in the excavation budget, as we get financing for the excavations but not for the restoration of the findings. The second case is an example from the excavations carried out at the Royal Palace or last year in the moat of Angkor Thom. These were shallow excavations and at the end of both campaigns I was delighted that all went safely. I even made a section of a berm fall as it threatened to collapse. What I mean is that in shallow structures we face percolating seepages of water. There are some clay layers, sometimes waterproof, then sand layers which percolations, side seepages dampen and might collapse. Therefore it is impossible to exhibit structures five metres deep under these conditions as beside the scientific nature of the work, there is also its beautiful aesthetic, notably at the Royal Palace where the soil is white and we would like to show it. But it is out of question to leave these excavations open. This does not satisfy everyone but we keep the recording and documents offering a visualisation. In my opinion this question deserves a longer discussion.”

*Comments from Mr. Bouchenaki:* “I would like to thank Mr. Gaucher, and also thank him in advance, as he will be in Rome on June 15th and will present his research as he did here. This will take place at ICCROM, as I consider this aspect of the excavation and post-excavation to be an important element for us who work on the issues of studying the restoration of cultural goods. Thank you Mr. Gaucher for travelling to Rome and presenting to our Italian friends and others the works you are carrying out in Angkor Thom.”

*Comment from Mr. Tan Bun Suy:* "I would like to mention the Phnom Kulen deforestation. I was shocked because I saw last year the same deforestation pictures, it continues. We are facing a great danger: as you know, on the Kulen are located the reservoirs, the basin supplying water to Siem Reap. Last year I made an intervention on this issue and again this year but I am sorry to see that deforestation has not stopped."

### **II.13 Detailed Jaya Koh Ker Project Plan of the Royal Angkor Foundation, by HE Mr. János JELEN, Chairman of the Board of Trustees**

[OrigE] "I would start with the motto of my organisation which is: 'a vision without a task is not a dream, a task without a vision is drudgery. A vision with the task is the hope of the world'. I would like to talk about issues at Koh Ker presently.

[diapo] We think that uncontrolled development destroys the outstanding universal values of Koh Ker as a potential World Heritage site. [diapo] The goal of the project: sustainable development secures the historical and natural values of Koh Ker as a world heritage site. The purpose of the project is to create a consolidated sustainable development master plan that will include proposals for a delimitation of the zones of influences and interaction. We wish to stop the deterioration of environmental heritage and community life and to establish sustainable development. A very simple project organisational chart was developed. We determined the three pillars of our activity: heritage, nature and community represented by clusters and groups of experts supported functionally by knowledge and experts in IT, education and training. We hope to have the support of a scientific advisory committee as well as an operational steering committee.

[diapo] We do not have time to go into the details supporting this ideology. If I simplified the three pillars, or main elements: sustainability, which as a term has been over-used over the last decades, means, to me, way of life. And when we are talking about capacity building I would rather stress a partnership and providing teaching to others. And when we are talking about the community we see around Koh Ker, numerous problem of communication between and among different groups of people. Then when we transform our pillars (heritage, nature and community) into a simplified project structure, we turn into sustainable actions.

[diapo] So we are doing 14 actions in the heritage field, 21 in the nature field, 3 in the community, 3 in the knowledge and 2 in the partnership fields. I won't go too much into details about the specific action. But to give you an overview I will introduce them. For example: emergency heritage intervention planning. We will try to see how we can save this gold mine or rather in this case the iron mine of Koh Ker. As we were preparing the project we found this production site of metal and ceramics. So we will focus on the processing of data.

[diapo] The archaeological topography is also a key issue. We spent two and a half months preparing on site with 15 experts and we considered that a landscape archaeological survey might be useful for our structure. The settlement pattern survey of this medieval site is certainly a key issue of knowledge. Again when we looked around, after the first impression we identified a lot of tasks still ahead of us and the question was raised on how to handle this amount. The environmental survey and reconstruction is on the mind of most archaeologists that spoke today and we will also do that. As for the on site management training, we just started talking to UNESCO, ICCROM, with Professor Von Baelen and also with the central European university. How we can provide three tiers of training not only on but also off site.

The historical monument topography produced the first results after three months of activity. Please bear in mind that we only sign the memorandum of understanding only on December 1, 2008 so not that long ago. Archaeological excavations are not so much on our mind, although you heard it is on the one of many of our colleagues. So we will try to cooperate with them and serve their interests then see how we can continue on our own. The

typology of the architectural decoration was also mentioned. The Chinese talked about their approach in Ta Keo. We certainly foresee Koh Ker as revealing a fantastic unprecedented new amount of data on the typology of decoration. The landscape and visual impact is also important because of the arrival of mass tourism. We will contribute to temporary structures, visitors centre, site museum were also mentioned by our colleagues when we met in January to build depots for the on going architectural activities. We have not decided yet on how we will contribute but we are already in the process of planning temporary structures if we get permissions from APSARA and the Government of Cambodia. I mentioned the typology of decorative elements which we are starting to process after collection of data.

I am deeply honoured that Professor Claude Jacques agreed to help us on the inscription. We will produce a database of inscriptions and technical on site information regarding the status of these inscriptions rather than trying to translate them or do whatever we can with them.

Mass tourism will come and we will try to have plans to manage it. We will also study the type of attraction that could divert mass tourism and we consider nature as particularly attractive and if we can save the characteristics of nature in Koh Ker, garden and meditative aspects, this could be of great contribution on our side. Nature itself would deserve longer details explanations but as I have already dedicated more than half of my time we cannot go through the 19 points. Let me just quickly explain what will happen in the next three years. <sup>[diapo]</sup> We will propose a new boundary which will be adjusted to the nature of the topographical features rather than squares, it will enable people to recognise it more easily.

<sup>[diapo]</sup> Land use and forest mapping: to design a layout to find ways to move around the minefields and marking safe locations. These are all operational issues but they are very important to us because we will move up and down in an area which was heavily mined. <sup>[diapo]</sup> Survey mapping: all different aspects of the biodiversity will be covered by our experts during the next couple of years. A botanical garden as was asked by our colleagues will be looked at and carefully considered. <sup>[diapo]</sup> Digital models will be prepared and as you can see on that picture we have already made the first version. Hydrological mapping is a key issue in Koh Ker. In this early phase we have already identified that water played a different role in Koh Ker and we hope it will resume playing this role, despite the absence of water that is suggested at the moment.

<sup>[diapo]</sup> Preparation of the land suitability map or issues related to the participatory land use planning: a few weeks ago, the government accepted a new royal decree on participatory land use planning. Biodiversity, forest and game management planning, nature of trades for green tourism management, botanical garden, tree risk assessment and removal plan; these are the issues which we have to handle.

My time is over and I have been asked to stop, but how can I stop when I talk about Koh Ker? There is so much to tell about it."

## **II.14 Analysis and visualization of residence patterns in greater Angkor, by Prof. Roland FLETCHER, University of Sydney**

<sup>[OrigE]</sup> "Co-presidents,  
Excellencies,  
Ladies and gentlemen,  
Colleagues,

Today I would like to outline a field of work which has been going on for nearly a decade, which purpose is to look at the overall landscape of the Angkor region, particularly in collaboration with Christophe Pottier of the EFEO. The result of this work is to show that the urban centres of Angkor are embedded within a great low-density urban complex and

that this format is the equivalent of the great conurbation which has developed in our modern world. What I am going to do is to overview the background information and summarise the data on the different settlements' localities throughout the Angkor area.

First of all I must give my compliments to all the members of the programme, particularly to my Cambodian and EFEO colleagues. The work that we are doing would not be possible without their support and administrative advice. This is a multidisciplinary archaeological programme and its work mostly lies outside temples and their enclosures, except for one instance that I will outline to you today.

[slide] What we are looking at is a vast complex that covers 900-1,000km<sup>2</sup>. Most of you already know this map. It derives from Christophe's work, and the use of radar mapping and comparative remote sensing data. What is becoming apparent is that the amount of detail available on the landscape and settlement patterns of Angkor is truly enormous. [slide] We have details here on the western edge of the Angkor complex, down to the level of individual rice fields. You can even see these on some of the spectra frequencies of the radar. The blue and white is the Angkorian rice fields underneath the modern rice fields. [slide] And if you look out of the window of the aeroplane you can see the Angkorian rice fields underneath the rectangular grid of the modern fields. That is a late afternoon image just after a rainstorm.

So what we are actually looking at is Angkor as a giant low-density urban complex. The point that I would like to emphasise is that low-density settlements are part of the normal range of human behaviour. Every social and economic system of human kind from hunter-gatherers through farmers through agrarian urbanism to industrial urbanism has used this kind of settlement system. Human beings live in everything from high-density occupation down to very low, dispersed occupation.

In the modern world the very famous examples are the megalopoli identified by Jean Gottman in the 1960s on the basis of the east coast giant megalopoli in the United States. This phenomenon is proliferating all over the world. If you travel from Washington in the south to Boston in the north, you will never be out of sight of buildings and you will also be driving through a great deal of open country with building structures all around you. This phenomenon is developing extremely rapidly in south and eastern Asia, and it has been given a name by Indonesian researchers: they call it 'Desakota', the rural urban, where the rural world is proliferating across a landscape and encapsulating the rural world as it goes.

[slide] What is less known is that there are famous examples of these type of settlements in the pre-industrial agrarian world. They are known in south Asia, for example in Sri Lanka, in Africa and most famously in Mesoamerica. One of the great contributions of American scholarship has been to identify settlement patterns associated with the Mayan civilisation, which is just one of the reasons my colleagues are here today. [slide] In south-east Asia you have famous sites like Pagan in Myanmar where you have scattered monuments spread across the landscape. And even when you look at the centre of such phenomena you have a walled enclosure as in Angkor, then you have monuments, structures and occupation sites spread far beyond that centre. [slide] There is a famous example which was actually mapped in 1896 by the British army in Africa, the predecessor to the modern city of Addis Ababa but at this point in time actually a mobile city. This is a place of 30,000 to 40,000 people and it used to move around the landscape annually, and this happened to be the moment when it stopped moving and was mapped by the army engineers. [slide] In Mesoamerica, famous locations like Copan, for example, with shrines in the middle, great temples and then occupation spread out in patches all across the landscape. On this picture left is Copan and on the right the latest Maya city of Sayil.

So what you see with low-density urban centres is that you have a distinct urban centre, something that is clearly visible, often very ostentatious and well-defined. You have several subsidiary centres and extensive low-density suburbs, but, critically tied together by a substantial route network of some form. There is a great deal of open land inside that

urban complex and the edge may be frustratingly undetermined. You have to live with this because urban planners of the modern world, for example in Los Angeles, have lived with these problems for 30 years. Defining the edge of these great sprawling urban complexes is extremely problematic and in the modern world you just draw a line. That is the only way to do it.

The key point to emphasise is that the word city has several meanings, certainly in English. It can mean an urban centre as for instance the 'City of London' and London, but it can also mean a greater urban area for example 'Greater London'. I grew up in London and I am perfectly happy with this logical dichotomy, these are complimentary in different sets of categories, and are not incompatible.

The first honour I want to make is to emphasise what has been said previously here that the work one does, as Newton said, stands on the shoulders of giants; a great deal of research has been done here. Bernard Philippe Groslier in the 1950s and 60s began to develop the concept of Angkor as a city of suburbs tied together by a water network. What we are now doing in the Greater Angkor project and in collaboration with the EFEO and APSARA is only defining the vision of Groslier. We now know the great network of embankments that defines the extent and the nature of this landscape.. [slide] These are in effects like the freeways of a modern city, they extend far beyond the urban complex, and there is a network that you can see that helps to define its extent. Very helpfully, the great definer of the location of Angkor as distinct from the rest of the rural landscape in Cambodia is the medium and large temples which form this very distinct patch on the landscape including, you may note, two very distinctive enclosures right on the outskirts, which form a set of boundaries, shrines and monuments for this amazing phenomenon. Recently, Christophe, Damien Evans and myself have been working with *National Geographic* to produce a new visualisation of Angkor, this is a schemer only but will give you an idea of this patch of occupation on the landscape.

[slide] Very briefly, to emphasise that the residence patterns of Angkor are triadic. There are three locations within enclosures which are those that have been envisaged for some time and formerly demonstrated by professor Gaucher's work and the work we have been doing on occupation along embankments and roads a can still be seen in Siem Reap nowadays, and then the prasat trapeang housemounds clusters which Christophe worked on first and for which we begin to develop a new programme. First of all, to honour professor Gaucher, his work inside Angkor Thom has clearly shown numerous occupations. We have yet to analyse that pattern but this is a profound contribution to the understanding of the city. Interestingly, some years ago Cham Chamroeun, working for the World Monuments Fund, conducted a survey inside the enclosure of the Preah Kahn which shows that there is a similar division of residential space, although it is apparently far less dense inside that enclosure. I would really like to follow-up on Claude Jacques' comments that this is the type of work that needs to be carried out on the Ta Prohm and Banteay Kdei in order to identify how these settlement systems worked. We have been doing an initial survey using Ground Penetration radar at the great site of Banteay Sra on the western side of the city, and the great thing about it is that the Ground Penetration radar will allow you to identify structures within these enclosures. So there is actually a non-intrusive tool that can be used for this kind of research.

[slide] The other locations upon which people lived are the great embankments which you can see here running across the landscape just pass Banteay Sra. When you excavate the canal, what you find is this very distinct grey- black material, low down in the channels which has ceramics, pieces of stone tools and equipment in it, and also organic material. [slide] The organic material preserved. On the right there you see bunches of leaves. Those leaves are dated to the 14<sup>th</sup> century, immersed in sand. What is happening is that the water is flowing through the landscape subsurface through these great deposits of sand and creating anaerobic environment. There is an immense amount of information sitting in these resources and the key thing to emphasise is that when you look at these materials the plants are identical. The plants you see today around Khmer houses, roads and embankments, the model of the Khmer world of having trees around the building is reasonably

affirmed by this material. <sup>[slide]</sup> Just outside Angkor Thom we have a stratigraphy of four metres deep with over 6,000 artefacts from occupation locations along the canal. We have information on the dating, the chronology being from the 12<sup>th</sup> and 13<sup>th</sup> centuries. And you can see today as you fly over the Angkor Siem Reap region the type of residence patterns we would be looking at. <sup>[slide]</sup> This picture shows modern Siem Reap, south of Route National 6.

<sup>[slide]</sup> You can then look at the housemounds, prasat and trapeang clusters of which, here just showing the prasat, there are an immense number in this landscape. This is a very complex and elaborate pattern strongly resembling many parts of the Mayan system. Their occupation is spread out around the rice fields in clusters but there are all within sight of each other. Early work on this and on the pre-angkorian era was done by Christophe at Prei Khmeng and the stratigraphy if I recall correctly is from the 10<sup>th</sup> and 11<sup>th</sup> centuries. <sup>[slide]</sup> At Nokor Kroul, to the north, outside Angkor Thom at Run Ta-EK, a new APSARA site, and at Sra Srang, we are conducting an occupation survey on this type of housemound. <sup>[slide]</sup> This is a survey of this huge occupation mound to the east of Sra Srang. People lived around the trapeang as they do today and what we are now moving into is using this material to build a 3D visualisation of Angkor. <sup>[slide]</sup> This is a 3D reconstruction by my colleagues at Monash of an area in the south of Angkor: a series of water tanks, prasat and housemounds. The key about this, it is built by a programme which takes the GIS base map, those fields here for instance are the line of the Angkorian fields, and it allows you to build on that surface any combination of trees, houses and locations that you wish. You can set a series of rules about where occupation is to be, how much density there is suppose to be, how many trees, how many buildings. So, for example, in the programme you can vary the number of an object. On this picture, low-density tree cover at the top and at the bottom a higher density tree cover.

These visualisations allow you to construct stories and views of this landscape. What I would like to do now is to show you some animated visualisations. <sup>[video]</sup> This is a created image on the fly coming from the west just south of Phnom Bakheng, running over these great lines and patches of housing past Phnom Bakheng, the moat of Angkor Wat on the south, crossing the road to Angkor Thom, and then from this point onwards going off to a landscape where from the moment we have no data. <sup>[video]</sup> Going the other way, this is from the south, flying over the great lines of the embankment, running over the western moat of Angkor Thom with Phnom Bakheng in the distance. As said you can vary the density, the frequency and structure of the occupation and you start asking a lot of questions like: 'how did you find out if there were a lot or a few or no trees?' You can see the great alignment of the road leading out to Angkor Thom to the north. One of the great qualities of the Cambodian landscape is haze; you can use haze to hide things you don't want to say anything about. <sup>[video]</sup> And last of all, when you want to be very creative you can add sound [sound and music are played by the video, the speaker remains silent for a few seconds]. Thank you very much."

## **II.15 Termites in Angkor, by HE Mr ROS Borath, Deputy Director-General, APSARA National Authority**

"Excellencies,  
Honourable Co-chairmen,  
Ladies and Gentlemen,

### ***I- Introduction***

After Mr. Roland Fletcher and the urban scale, may I bring you back to the scale of the insect. In the Angkor Park, termite nests are part of the landscape. They can be found everywhere: in the rice fields, in the undergrowth and especially in our monuments. These termite nests 'camouflage' and 'mimetic' so well that they remain almost unnoticed.

These termites have been studied since 2004. Most of them have been identified in order to improve our knowledge and to list the different species living in the territory of Angkor. Adequate measures in line with environmental constraints must be taken for treatment. This means the finding of a non-polluting approach with no side effects, to prevent invasion and thereby safeguard the monuments.

## **II- termites and their environment**

Termites are social insects and usually inhabit huge 'nests'. They build these 'nests' in trees above ground and feed from the different types of wood, either hardwood or soft-wood, abounding in their environment.

Termites are extremely sensitive to temperature, humidity and light and cannot move on open terrain, contrary to most insects. They move in mud- filled tunnels.

## **III- Different species of termites in temperate zones or in tropical Asia**

Termites, also known as 'white ants', are the sole representatives of the *Isoptera* with 280 genres and 2,500 species grouped into twenty families. They belong to the animal kingdom and are listed as insects. They can be found mainly in hot countries, particularly in the tropical regions of the Far East, Africa, Central America and South America. They can also be found in temperate zones.

As ants they are social insects which live in hierarchised colonies, organised into castes and displaying a great collective intelligence. The 'workers' and 'soldiers' are apterous and the reproductive termites have wings. The wings fall after the mating flight. They fear light and are often blind.

**Morphology:** They are characterised by large mandibles, and an abdomen connected to the thorax. During their growth, termites are characterised by an imperfect metamorphosis (larvae looking like adults). A couple reproduces larvae which, after several moults, turn into workers and sterile soldiers or pupa which will produce reproductive adult termites- which are in turn able to reproduce.

Termites feed mainly on wood and leaves through their large mandibles.

Termite society is characterised by a complete interchange of food through all its members; this is called trophallaxis. This means that food interchanges through the alimentary system of a colony within three days. This is a very important point when treating termites.

The termite nest is made of chambers and galleries. The workers are in charge of building the nest and supplying food to the soldiers, who defend the colony.

### **Six species of termites were inventoried in the Angkor Park**

1. The *Macroterm* is the most numerous genus of termite in South-east Asia. In this group, soldiers are of two sizes, the 'major' and the 'minor'; their head is subrectangular with large mandibles and an abdomen connected to the thorax.

Three species of this population were found in Angkor: the *Macrotermes carbonarius*, *Macrotermes gilvus* and *Macrotermes sp.*

They all build huge nests in battered soil along walls and on the ground inside monuments.

2. The *Globiterms species* are characterised by their round- headed soldiers with stronger, curved mandibles and teeth on the internal edge of each mandible. The species researched in Angkor is the *Globiterms sulphureus*. This species builds small mounds and feeds on dry wood and vegetal debris.

3. The *Microtermes species* are usually smaller termites. The head of their soldiers is oval and they have teeth inside their left mandible.
4. The *Microtermes* are characterised by the subrectangular and extended head of their soldiers. The species found in the Angkor Park is the *Microcerotermes crassus*. This species builds nests on trees and sometimes partially buried in the ground.
5. The *Terms sp.* is a type of termite which is commonly found in the tropical regions, such as the *Terms Lanticornis*. Their soldiers are of a pale yellow colour with brown stains. Their rectangular shaped heads are partially covered with hair.
6. The *Coptotermes sp.* are of medium size and are characterised by oval shaped heads covered by thin hairs and the presence of a fontanel at the back of the head. The mandible is shaped like a curved sabre.

#### **IV-The impact of termites**

All inventoried termites, apart from the *Coptotermes sp.*, belong to the *Termitidae* family.

Termites build their nests in the soil and sometimes overhanging above ground. Although these termites do not cause any damage to the temples, the construction of these termite nests might threaten the infrastructure and superstructure. This activity could cause lifting, deformation, destabilisation and collapse the built-up area.

The presence of *Coptotermes species (Rhinotermitidae)* inside the monuments requires the planning of interventions and stringent monitoring.

The *Coptotermes* are famous for being the most destructive species in the world. They attack the wood of healthy trees. These dangerous and 'secret' termites are difficult to locate. They can only be identified once the damage has been done and is too severe to be treated.

#### **V-Location of termite nests in some monuments of the Angkor Park**

Here is a map of the different locations where the termites were monitored, studied and photographed:

- Termites in Wat Athvear; They are almost everywhere in the interstices.
- Termites in Banteay Srei
- Termites in Phnom Bok
- Termites in Phnom Bakheng
- Termites in Bakong
- Termites at the Bayon

#### **VI- Strategy to alternatively manage termites**

There are three treatment options for Asia to manage termites. They are the following:

- 1/ the use of liquid chemical spread within the soil,
- 2/ the use of toxic chemical in powder,
- 3/ the use of food baits for termites.

- 1/ The use of liquid chemical spread within the soil,

This method consists of creating obstacles in the soil in order to slow down the progress of the termites towards their food sources, for example by building a chemical barrier to stop the invasion. To this matter the obstacles must be sealed.



When the pesticide barriers start diluting with time and do not operate with the same intensity, other colonies might arrive.

2/ The use of toxic chemicals in powder,

The use of product such as arsenic to manage termites goes together with installing the soil treatment barrier.

The soil treatment barriers do not kill termites, the arsenic dusts acts in addition in order to finish the treatment. Arsenic is a known cancer agent which does not dissolve in the environment: this might trigger risks of contamination and pollution; the use of arsenic is forbidden in many countries. *Triflumuron* is also forbidden, it is commonly used as a powder acting agent.

3/ The use of food baits for termites.

The termite baiting system is a new approach to fighting termite invasion and the colonisation of termites without polluting the soil, as there is no contact between the baiting boxes and the soil where they are placed. It is an ecologically viable solution. The treatment process is called: the 'Exterra™ Termite interception' Baiting System.

The closed and locked Exterra interception Stations (mainly Eucalyptus) are placed as bait. These Stations are monitored on a regular basis to detect the presence of termites. Once attracted to the Stations, bait, the active ingredient 'Requiem Termite' is added.

The termites which caught the bait turn white and their mandibles soften. They die within four weeks and the entire nest is eliminated within three months.

### **Conclusion**

We estimate 60 monuments of the Angkor Park and 4,500,000 square metres are infested. The infestation grows on a daily bases and will continue to do so if measures to preserve the Angkor Park (site and monuments) and fight this 'pandemic' are not set up quickly.

I would like to thank in advance the *Ad Hoc* experts who already have a considerable load of work to shed light on this matter.

I would also like to thank Doctor Ahmad Said Sajap (PhD), of *University Putra Malaysia*, for his assessment report and recommendations for the treatment of termites. Thank you for your attention."

### **II.16 Living Angkor Road Project: overview of results, by Mr IM Sokrithy, archaeologist, Project Coordinator, APSARA National Authority**

[OrigE] "Excellencies,  
Co chairmen,  
Ladies and Gentlemen,

To give you an idea of our project, it is a joint Khmer-Thai research project on the Royal Road from Angkor to Pimai. The project started in October 2005 and ended in October 2008. The project studied historic roadways, communication links and human settlements along the Royal Road of the Khmer Empire. There was also a study of the ancient metallic and ceramic industries. The most advanced technology was applied in the fields of remote sensing, GRS, anthropology, archaeology and geophysics. Data collection will be developed from the project, which can be further utilised by other related works in the fields of heritage conservation, land- use planning, tourism, cultural management, etc.

The findings of the archaeological studies on the Royal Road are as follows: in theory the road was straight but it was diverted when it crossed some communities and agriculture sites. <sup>[slide]</sup> Here you can see, about 20 minutes from Angkor, the structure of the road built by four layers of compact soils with a width of 30m flanked by two canals. The road is about 10m. <sup>[slide]</sup> At the same time at another site in Cambodia, our Thai partners carried out excavations in an iron smelting site, the furnaces, and you can see in this picture the remains of blacksmith tin at the same level as human skeletons buried close by.

The most important work is the finding of Darmasala. <sup>[slide]</sup> The 17 structures listed in the inscription of Preah Khan were found: eight in present day Cambodia and nine in Thailand, as presented on the map. These are patterned structures and there are four water ponds located in corners. <sup>[slide]</sup> Also, 32 stone bridges were found on the road from Angkor to Pimai: 20 in Siem Reap province, 12 in Oddar Meanchey and none in Thailand. The longest is located in Oddar Meanchey 150Lmx 31.5Wx 28H, the shortest was only 7.5 x 6.10 x 3m. The one presented on the drawing is the shortest.

<sup>[slide]</sup> Based on our analysis of the structure of the bridge, we came to the conclusion that the load capacity of the bridges reached up to 40t. <sup>[slide]</sup> Numerous temples were found along the road: 87 temples, 68 pre-Angkorian and Angkorian bridge structures, 13 in sandstone and six in laterite. <sup>[slide]</sup> Here is a picture of a staircase we found along the road to Pimai. 47 temples, 67 iron smelting sites and 40 ceramic sites in Thailand. Also ancient hospitals: as you know one or two were built during the reign of Jayavarman VII, and we found four along the road. And if we make a calculation there is a distance of 40km between each and the typical traveller at the time needed one day to reach one hospital. <sup>[slide]</sup> A lot of water structures were found, 385, here in blue which we can define into 65 types of structure. To define them we found some of them in inscriptions and their names are still in use. <sup>[slide]</sup> More exciting are the two passages that were found through Danmrek: one an oxcart passage and a pedestrian passage of laterite steps. These are still used. <sup>[slide]</sup> The laterite step passage is about 1,000m long and 11.5m in width, with four bridges and a huge terrace flanked on the corners by elephant or lions and by outlets along the laterite steps.

<sup>[slide]</sup> The ancient industry survey of ceramics and metal industry production: this picture gives you an idea of the mapping in Cambodia and Thailand of those sites. Here, the ceramic production located along the road. There were three types of ceramic found: Khmer, Chinese and Thai. This is to give you an overview of the history of production. <sup>[slide]</sup> Another important point of the study is the cultural study and anthropological survey among the communities along the road, especially of the Kuy ethnic minority. Here is the mapping of the Kuy ethnic minority who were elephant hunters and iron smelters. <sup>[slide]</sup> This is the database on that picture. In the vernacular language, the Angkor Pimai road has different names, either ancient or modern. The older one means literally Royal Road and was found in inscription K 175 of the 10<sup>th</sup> century, and identical terms are also used for bridge names.

<sup>[slide]</sup> Another point is the technology used: remote sensing and GIS in order to map the site and create a base map, analysis of the missing elements, development a GIS database and internet application. <sup>[slide]</sup> Here is an example of our mapping of the ancient Kuy community. Here a community were was found: three stone bridges, the Royal Road passing by, an 11<sup>th</sup> century Angkorian temple, hospital and rest house. <sup>[slide]</sup> The data are uploaded on the internet; here is a picture of the website. We also upload the data on Google, <sup>[slide]</sup> here you have a view of Angkor, and from Pimai to Angkor.

Publications: <sup>[slide]</sup> last year the Vietnamese journal of archaeology published our paper and they also used our picture for their cover. The article was translated into Vietnamese. Here a new publication on a case study of our work in Uddaya, issue number 8. Most of you I am sure have a copy already.

To conclude: the road was not built before the 9<sup>th</sup> or 10<sup>th</sup> century but by the 11<sup>th</sup> century, it is possible that the entire stretch between Angkor to Pimai would have been completed, whereas the stone bridges were probably built between the 11<sup>th</sup> and 12<sup>th</sup> centuries. The next stage is to study the road to Wat Pu and to Sdok Kak Thom to the west and to study the history of Angkorian roads' associated structures, ancient industries along the axis and human settlements. The research project will be conducted by the team of the APSARA Authority working on Cambodian territory and will take 54 months. The best technology will be applied for this research. The data developed may be further utilised in the fields of heritage conservation, cultural management, land use, tourism, etc. <sup>[slide]</sup> Here is the scope of our next project: this is the grand axis from Angkor to the west and east. <sup>[slide]</sup> And I give you an overview on the last work in the region of Phnom Srok; you see that stone bricks were found and also on the way to Wat Phu the next field work will be on the cross section to the east of Batchum. <sup>[slide]</sup> These are pictures of our preliminary visit to Wat Phu last year. You can see the important site and the road still visible for about 80km from Wat Phu to the border. <sup>[slide]</sup> Here are pictures of temples and here an inscription dated from 1128. This inscription mentions a long story about a great war expedition led by Jayavarman II. So I think this is a primary source for study of this axis."

## II.17 Progress report on the Angkor Inscription Survey, by Prof. T. S. Maxwell, Bonn University

<sup>[OrigE]</sup> "Excellencies,  
Co-chairmen,  
Ladies and Gentlemen,

As I mentioned last year at the 17th Technical Session, the Angkor Inscriptions Survey Project (AIS) was started in February 2007. By the end of that year, we had surveyed 133 inscriptions in the Angkor region and in Koh Ker. This year, we have already documented 215 inscriptions and the number will increase as our operations proceed.

The inscriptions dealt with by the AIS project are not those already protected in the Conservation d'Angkor, or in museums, but those inscriptions that are still *in situ*, in their original temples. These are the inscriptions that are under threat of destruction. The primary purpose of the AIS is to preserve these *in-situ* inscriptions chiefly by three means – (1.) detailed documentation of every inscription, (2.) physical conservation, and (3.) publication. I will go into more detail about these three means. This year (2009), our coverage has been extended from our original field of operations (Roluos, Angkor, and Koh Ker) to include the inscriptions of Banteay Chmar.

### 1. DOCUMENTATIONS

The documentation consists of a structured analysis of each inscription. Each analysis document runs to approximately 30 pages including photographs, maps, plans, and other illustrations including connections with other inscriptions elsewhere. These documents are then gathered together in one major AIS Report. <sup>[slide]</sup> The first such Report, which you see here, consisted of two volumes and ran to 778 pages. Copies of this Report are deposited in the Library of the *École Française d'Extrême-Orient* and in the International Documentation Centre, and can be consulted there. The next Report, which will necessarily be considerably larger, is scheduled to appear, in several parts, in 2010.

I have requested that the Secretariat distribute packages containing three of our Individual Reports to you, as *separata* from the draft 2009–2010 Report. Each of the three sample reports in the package deals with a single inscription, one at Bakheng in Angkor, one in Prasat Domrei at Koh Ker, and one, recently discovered, in Structure 45 at Banteay Chmar. Together these three Individual Reports provide you with a reasonable impression of the kind of work that the AIS is carrying out. I will refer to these again later.

## 2 - OBJECTIVES

The objectives of this work are also briefly described in a separate sheet in the package that you have received. For convenience's sake, I repeat them now:

1. The primary aim of AIS is to preserve and explain the *in-situ* inscriptions of historical Khmer temples. The condition of all these inscriptions is very rapidly deteriorating.
2. To survey all the surviving inscriptions on the temples of Roluos, Angkor, Koh Ker, and Banteay Chmar (other temples are being considered for inclusion).
3. To analyse these inscriptions from the point of view of location and accessibility, present condition, and risk assessment, and to prioritise them for conservation treatment.
4. To analyse, transcribe, translate, and comment on their content and their historical and aesthetical value as documents, and to pass this information to the conservation teams.
5. To publish and communicate all this information, in the form of detailed technical reports, to conservation units, linguists, historians, and anyone with an interest in ancient Cambodian temples and their original purpose and function.
6. To make the general public, especially tourists, aware of the cultural value and national importance of the inscriptions, through more popularly accessible publications including documentary films and English translations.

## 3 - QUESTIONS

Turning now to the relevance of all this work – to whom is it relevant?

Question 1: why do conservation teams need to know what an inscription is about, before they restore it?

Answer: the methods of AIS are non-interventionist because this project is not specialised in conservation. AIS is specialised in the languages, script, meaning, and the role and functions of temple inscriptions in Khmer history. This is the reason for the project's existence. Because of the very great importance of the inscription texts, AIS wishes to actively cooperate with all conservation teams to preserve these historic texts from further deterioration and loss: that means the original inscriptions. With regard to inscriptions, it is vital that conservationists understand exactly what it is that they are preserving in each individual case, because this knowledge directly affects the reasons for undertaking conservation work, and the methods and techniques applied.

[slide] The AIS Reports supplies information that will help conservation teams as follows. The reports help:

- A. to locate inscriptions;
- B. to understand the physical situation at the site (which parts of an inscription are missing but might be found again during conservation work, which parts are broken off and scattered about the site, etc.); for example in this picture from prasat *Chen*.
- C. to be advised in advance of the general condition of the stone surface and of the inscription text as it is today; that should help in planning and programming.
- D. to have a "map" of the inscription showing the number of lines, which gaps are the result of erosion and which are intentional because there are intentional gaps in inscription; exactly which portions of the inscription are still in place but damaged or eroded or otherwise in need of special attention and protection, and notes on the script (the writing itself) so that the importance even of very small features in the writing (such as microscopic dots, circles, or hooks) – which are vital for understanding the meaning of the text: these have to be preserved as much as possible and not ignored. [slide] This is a typical map we produce, the dotted lines represent missing text from perhaps 50 years ago, and the yellow represents what is missing today. So you can see how fast the erosion has spread.

## Question 2:

[slide] Why do tourists need to know what the inscriptions are about?

Answer: because they want to know. When AIS is working on any inscription, tourists in large numbers—who otherwise would not see these inscriptions—always ask for information about what the inscriptions say. They very seldom get any answers from other sources. And, equally important, because the more tourists understand about the inscriptions, the less likely it is that they will cause damage through negligence or lack of due care. The problem of inadvertent damage to inscriptions by tourists is one of the issues addressed in the AIS documentary film.

## Question 3: why does anybody need to know what the inscriptions are about?

Answer: because the inscriptions are the only sources that exist for the history of pre-modern Cambodia. They are the only authentic sources of information about the temples, written by the people who built them, and also the only written sources that exist on the workings of Khmer society at the time. It is time the inscriptions were all re-read from the originals on the temples, mistakes in old readings corrected, and new translations made. This is one of the tasks of the AIS.

## Question 4: what results have been achieved?

Answer: in 2008, AIS produced the public awareness documentary film on the inscriptions of Angkor, entitled "Opening the Eyes – Inscriptions as Gateway to the Gods". This was screened here last year at the end of the ICC Technical Session, and was also shown at the Cannes Film Festival. In case you missed it, and would like to see it, I have ten copies of the film on DVDs which I can distribute – please speak to me after the session if you would like to have one.

- [slide] The AIS Conservation Priority List for the conservation of inscriptions in the Angkor region was produced in 2008 and passed to GACP.
- The AIS Interim Report for 2007, produced at the end of that year, has been deposited in the EFEO Library and the International Documentation Centre. It contains illustrated Individual Reports on 133 inscriptions in 27 temples at Roluos, Angkor, and Koh Ker.
- The Second AIS Report is scheduled to appear, in four parts, starting in 2010 and continuing through 2012 and possibly beyond. This expanded Report will contain more substantial and detailed analyses of the inscriptions published in the 2007 Interim Report. In addition it will contain reports on newly discovered inscriptions found in Roluos, the Angkor region, Koh Ker, and Banteay Chmar, of which you have examples in the handout package. All these inscriptions, I repeat, require protection and conservation.

## 4 - PROGRESS IN THE PAST YEAR (July 2008 – June 2009)

The increase of material in the draft Report for 2009-2010, from 133 to 215 inscriptions at the moment, is the result of continued AIS activities in the Angkor region at Banteay Thom, Prasat Chak Chek, Prasat Chrung Southeast—with just the remains of an inscription there, Prasat Vat Prasat, and Ta Som in the Angkor region, at Prasat Boeng Veng in the extreme north of the Koh Ker zone, and two surveys in Banteay Chmar.

Let me mention three specific examples here:

● Example 1: [slide] as a result of discussions with M. Gérard Diffloth of the *Ecole Française d'Extrême-Orient* and of our cooperation with the German Apsara Conservation Project, a new inscription has been found in Prasat Chen at Koh Ker. This is a particularly important find for Prasat Chen, because all the other *in-situ* inscriptions in the entrance zone (mostly from the collapsed gopura) are broken into fragments that are scattered over a wide area. This is the first complete inscribed surface to be found in that zone. This photograph is by Emmeline Decker of GACP. It is an inscription of 13 lines, in Old Khmer, and is part of the list of personnel of the temple, containing 34 legible names. At least one more line of text remains buried under the earth, but we hope for the cooperation of the

APSARA authority to have this space carefully cleared so that the rest of the text can be read and translated. There may be a date, and perhaps the total number of temple servants, on the as yet unread portions of this inscription.

●Example 2: <sup>[slide]</sup> as a result of the AIS project's explorations in the forest surrounding Bakong, we found an inscription in one of the brick temples, outside the second enclosure on the west side. That inscription is also in Old Khmer. This is also a personnel list, and names two villages and the pramān (Territory or District), which presumably lay in the vicinity of Bakong. There are nine legible names of persons from the first village, and 8 from the second.

●Example 3: <sup>[slide]</sup> This is the most exciting, and in view of colleague behaviour I refuse to believe this. In Banteay Chmar, an inscription was found in Structure 45 in the Eastern complex within Enclosure 1. It was already known to exist, but had not yet been read or interpreted. This is a highly unusual and extremely valuable text, containing 5 lines of which 4 are in Sanskrit. One of its unusual features is the use of Sanskrit in a short doorframe inscription--all the other doorframe inscriptions of Jayavarman VII's reign are in Khmer, and therefore in prose, not in metrical verse, as is the case here. Its other extremely unconventional feature is that it is written by the author in the first person. Personal memoirs did not usually get inscribed on temple doorframes. The inscription contains the date of the visit of *Viraśakti* to Banteay Chmar (1130 Śaka, that is 1208 AD), in a word-code as is usual in Sanskrit inscriptions. As we know from two foundation stele inscriptions in the Conservation, this Buddha, *Viraśakti*, usually referred to as *Viraśakti-Sugata* (sugata is another word for *Tathagata* or Buddha), was also carried to the Ta Prohm and Preah Khan temples in Angkor during the Spring festival. We do not know in what form this Buddha was carried around the temple, but this Banteay Chmar inscription implies that it was in the form of the sacred fire, which was a portable deity, as we all know from the Angkor Wat reliefs.

The text is a personal statement by one Madhurendrasuri, a famous name in ancient Cambodia, borne by several ministers at various times, both before and after the 13th century. The Madhurendra who wrote this inscription at Banteay Chmar did so to tell of his presence at that temple during the visit of *Viraśakti*, his witnessing of the sacred fire that was kindled on that occasion, and its dispersal in all directions across the Kingdom of Jayavarman (jayavarmma-rājye). This might imply that it was going from firehouse to firehouse along the highway. In view of the date, this can only refer to Jayavarman VII, and so the inscription re-confirms that this king was still on the throne in 1208 AD (as we know also from other inscriptions – M. Jacques has shown that he may have lived until 1217 or 1218 A.D.)

The first line of this inscription is in Old Khmer, not in Sanskrit. It is the invocation of the Sacred Fire as *Vraḥ Vleṅ*, followed by the word *Svargga*, meaning "The Sacred Fire from Heaven". In the Sanskrit verses that follow, this is literally translated in Sanskrit as *Agnir Divaḥ Patan*, that is, The Fire Descending from Heaven, to which the Sanskrit adjective *Dir̥mukha* is added, meaning that the fire faced, or proceeded, in all directions. It is another remarkable feature of this text that the god is first invoked in Khmer, and then his Khmer name translated into Sanskrit – a feature that shows that, at the time when Madurendrasuri composed this inscription, the Sacred Fire was considered to be primarily a Khmer phenomenon, not a Sanskritic one.

Also at Banteay Chmar, AIS found what appears to be another *Vraḥ Vleṅ* inscription, in Structure 15, which is a face-tower. Space was left underneath perhaps for more Sanskrit verses which however were not inserted. Both of these structures (45 and 15) are located in the Southeast quadrant of their respective complexes, and the Southeast is the symbolic direction of *Agni*, god of fire, which strongly suggests that these two buildings were the fire-temples (*agnigṛha* or *agnyāgāra*) of those two zones of the vast Banteay Chmar complex. So we come one step closer to understanding the kind of Buddhism that was practised at Banteay Chmar, and the way in which this enigmatic temple functioned as a religious establishment, through the inscriptions. Thank you very much."

## GENERAL DISCUSSION

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*Observation from the Co-chairman for France:* "it is now time for discussion. Mr. Jacques, Professor Fletcher asked you a question".

*Answer from Mr. Claude Jacques:* "I do not have a lot to add though I was very interested by the presentation. But I would like to make a comment on the last intervention which was highly interesting, as this conservation effort for inscriptions is critical. I wanted to talk about the *Virashakti* Buddha mentioned in this inscription and which is of interest. It was the main divinity of the Wat Nokorm temple of Kampong Cham. And it was actually invited to the annual ceremonies of the Ta Prohm and Preah Khan temples and I notice that now it is also invited to Banteay Chmar temple. It is then very interesting to see that these main divinities during the reign Jayavarman VII were invited into the great temples of this period".

*Comments from Mr. Beschaouch:* "just to say that I was very interested by Professor Fletcher's paper. He also enlarged his demonstration to examples taken worldwide, perfectly sustaining his analysis. I would like to point out to him—and both of us can do this, Mr. Bouchenaki and I—that we had the same system in the Greco-roman world. And that he could find in many books published on the relations between the town and the territory, within the Greco-roman context, the best examples would be in south Italy and in countries in Northern Africa, in particular Algeria and Tunisia. A balanced town is that which is used as a place of consumption and administration with a production territory, and balances perfectly with its satellites. I work on the Carthage region, an area of 100km between Carthage and the last point delimited by a marker. And within this huge territory there is a major city Carthage, as is Angkor here, and on the whole territory satellites with a spatial organisation which allows space for production. This is a lesson coming from antiquity, a lesson from the middle ages and Angkor which was sadly lost on the modern world. And this is a wish I have for our Kingdom of Cambodia: that this lesson from the past shall not be forgotten and that there will not be any megalopolis without space for production and activities. Because this is what civilisation is all about: to provide for a town the possibility to grow whilst being in harmony with its territory. Thank you for your attention".

*Observation from the Co-chairman for France:* "this also proves that at this time from one continent to the other, space was structured in similar fashion. No more questions, we will then close this morning session."

## III. SUSTAINABLE DEVELOPMENT

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### III.1 Method of operation of the *ad hoc* group of experts for sustainable development, by Mr. Azedine Beschaouch, ICC Permanent Scientific Secretary

"Thank you Mr. Co-Chairman, I will be brief to save some time. The sustainable development experts which are here and I introduce: Mr. Jean Marie Furt, a Professor at the University of Corte in Corsica, M. Testuji Goto, an expert working with Jica and a new one, Professor Pierre Grand, expert in development and who, throughout his career, has had to deal with problematics vital to sustainable development such as water and tourism.

So what we expect from them is that, contrary to their colleagues, they do not visit sites, but they build a reflective thinking and that they communicate with the bodies in charge of sustainable development: mainly the APSARA Authority and also the newly-created Tonle Sap Authority, and, if it is desired by HE the Deputy Prime Minister Mr. Sok

An, the Ministry of Tourism. We have already had a meeting, so with the ministry of Tourism we will study the conditions improving hosting facilities and the development of the town of Siem Reap in order for the town to avoid suffering from the economic crisis and to host in good conditions those wishing to visit Angkor. This was then to inform you of the fact that these experts are entrusted by the chairmen in the plenary and technical session or if requested by the APSARA Authority, with any kind of activities. If not they have to think and take initiatives, listen to the national authorities and to the issues raised. So that's what we are expecting from you and I think that our internal rules are adequately drafted, as our *ad hoc* experts answer to the chairmen not only for their neutral and independent judgment but also for their operation with the secretariat. Thank you."

### **III.2 Report: Colloquium on establishing a working group on the issue of water in Angkor and the Angkor Region, by Mr. Philippe Delanghe, Culture Programme Specialist, UNESCO Office in Phnom Penh**

[OrigE] "Excellency High Representative of His Majesty the King,  
Excellency Deputy Prime Minister,  
Excellency Governor of Siem Reap,  
Excellencies Co-Chairs,  
Ladies and Gentlemen,

'Water is our National Heritage': these are exactly the words expressed by His Excellency the Deputy Prime Minister during an informal discussion the day before yesterday. As such it is not surprising that His Excellency has given his constant support to the organising of the water colloquium by APSARA in close cooperation with UNESCO since 2007.

On June 1st, APSARA, in close collaboration with UNESCO, organized the "Fourth Water Colloquium for the region of Siem Reap". This colloquium has a special meaning not only because we were honoured by the presence of the governor of Siem Reap during the whole working session, but also because it can be seen as the crown on the work which started in 2007. But, before going more into detail, let me recapitulate some history.

In 1995, APSARA and UNESCO organised an "International Seminar on Water and Angkor", more specifically looking at the inter-relation and interaction of both. There was however, no immediate follow-up and, meanwhile, the situation in Angkor and Siem Reap was changing rapidly.

These changes, related to tourism, urban development and environmental impact triggered discussions with the Japanese experts from JASA in June 2007. It was after these discussions that our UNESCO Office in Phnom Penh took the initiative in close cooperation with APSARA to contact the different national and international actors and decision makers working in the field of water. The overall positive reactions led to the organizing of the first water colloquium on November 27, 2007 in the margin of the 14th Technical session of the ICC-Angkor, bringing together national and international institutions. The recommendations formulated at the water colloquium was mainly related to the western Baray, the Tonle Sap, the need for centralised data and the establishment of an environmental observatory, very much reflecting existing concerns.

The second colloquium organized on the 3rd June 2008, brought together actors from the private sectors with a lot of representatives from the hotel and guesthouse sector. Recommendations formulated during that colloquium pointed strongly in the direction of the conservation of water resources, the protection of water reserves and the recycling of wastewater.

The 3rd colloquium then, organised last December, discussed the possibility of the establishment of a working group that would allow the implementation of activities in re-



sponse to the recommendations formulated. This brings us back to the first of June and the fourth water colloquium.

I very much feel the colloquium was a great success as it answered the request of the third colloquium, namely the establishment of a "Siem Reap Water Working Group (SRWWG)", under the format of a draft *prakas*.

Let me just quickly introduce you now to some of the Articles of the draft PRAKAS and especially those relating to its general structure and the Articles of interest to the ICC-Angkor.

Article two is of particular interest to the ICC. 'The SRWWG is a working group established under the auspices of the Royal Government of Cambodia. This working group will cooperate with UNESCO and it will establish a close relationship with the ICC for Angkor'.

#### Tasks of the Working Group:

1. Protection of Urban & Rural Areas from floods and/or droughts in the geographical extent as mentioned in Article 3. Article 3 is a map I will come back to that later.
2. Conservation of water resources & the protection of water reserves;
3. Recycling of wastewater;
4. Protection of surface water and ground water from pollution.
5. Sustainability of the groundwater level in the Angkor Area.
6. Stabilising of the Siem Reap riverbed;
7. Increase of the infiltration of ground water, protection of the forest and reforestation.
8. Development of a strategy and a general management plan for immediate action on water issues in the geographical extent as mentioned in Article 3;
9. Collection, processing and centralising of all data concerning water in the geographical extent as mentioned in Article 3;
10. All others actions needed to reach the objective mentioned in Article 3.

[slide] This is a lay-out of the structure as proposed in the draft *prakas*. As chair we propose the deputy Prime Minister and as Deputy the Siem Reap Governor. The steering committee includes the chair then the different members, the secretariat, which will be assisted by UNESCO, and the different members as is illustrated in the structure. One last part of article 10 is important for the ICC: 'the SRWWG shall meet just before the ICC-Angkor technical session to formulate recommendations with relation to current and future projects to be submitted to the ICC-Angkor plenary session'.

It is our sincere hope that this *prakas* will become official at the earliest convenience, so that the SRWWG can enter its operational phase and start its activities."

Comments from the Co-chairman for Japan: "thank you Philippe for this report. I think we should talk a little bit about the relationship between this working group, our committee and especially the technical session. We feel that this water colloquium was a success, as after four meetings, an intergovernmental coordinating group has been set up. We consider this as a highly important step towards solving this specific issue regarding water. As the ICC mission is to deal with issues pertaining to sustainable development and specifically those affecting the Siem Reap Angkor region, we found it very useful to create an interface with this new working group constituted by the government and the ICC technical session, within the framework of our session on sustainable development. So what I would like to propose is that during the next technical session we will meet with this new group created by the government, and the members meeting for the technical session. This could be called a thematic session on water, a spin-off from the sustainable development session which will be held next year."

**III.3 French Ministry of Culture Cooperation, Architecture and Heritage Directorate, by Mr. Bruno Favel, mission coordinator for European and International Affairs, Ministry of Culture and Communication, France**

“Honourable Deputy Prime Minister,  
Honourable Ambassador for France,  
Honourable Co-Chairmen,  
Dear Colleagues,

As you know, the French Ministry of Culture, with the support of the French Embassy in Phnom Penh and in collaboration with the French Minister of Foreign Affairs is active in the setting up of support for the training of Cambodian staff. This training is mainly in the fields of architecture and archaeology. I will skip the historical background that I wanted to quote, as we are short on time.

We focus on three fields: 1) the Regional Heritage Training centre, 2) the training consultancy with preventive archaeology and 3) finally the field regarding architectural and the latest initiatives carried out.

Regarding the Regional Heritage Training Centre, our assessment was that in Asia, and worldwide, historical monuments have been decaying and threatened by the lack of knowledge of the professionals working on these monuments. We then decided to strengthen the training of architects who had already graduated in the field of heritage, something we have done in other countries. This training is modelled on the famous *École de Chaillot*, which most of you here know about. This model has already proved successful in Tunisia, Morocco and Syria and also in Central Europe. It trains architects on the necessity of awareness of the monuments, and that these monuments and ancient quarters need to be preserved. Moreover, acting Angkor is an example, a landmark site for conservation, preservation and restoration of temples. It was then vital for us at the Ministry of Culture to address architect training so that future generations could have monuments standing in what I would describe as proper conditions.

This year is the second operating year of the training programme and this afternoon, Mrs. Sisowath and Mr. Ulisse will present the curriculum and operation of the centre. It is gaining fame in Vietnam, Laos, Cambodia and other Asian countries. I must admit that it is comforting for us to know that the priority solidarity Funds managed by the French Embassy are reaching out to rightly train these architects in heritage, with the assistance of course of UNESCO.

In the fields of consultancy and expertise, the National Institute for Preventive Archaeological Research (*Institut nationale pour la recherche préventive*, INRAP) works on issues pertaining to the training of archaeologists. Concretely, on the sites of Beng Meala, Koh Ker and Preah Vihear, teams were trained with APSARA and with additional work placements in France. As we speak, Mr. Eric Llopis is drafting a handbook on the cooperation in the field of preventive archaeology. In the field of architecture, several Cambodian architects were trained in architecture colleges in France. They, therefore, must find work in international teams and can train on the bases of multidisciplinary expertise with their archaeologist colleagues in Cambodia. Also—and this is an appeal to all the international teams—integrate Cambodian architects into your teams.

Regarding tourism, it would be relevant to carry out an analysis of the types of cooperation being developed by APSARA with major institutions, such as Versailles or the National Centre for Historical Monuments (*centre national des monuments historiques*) or any other bodies. We are interested in setting up a reflection on the development and training of other Heritage professions, because architects and archaeologist are trained, but, for some professions, training remains minimal. This shall be developed in order to graduate high level professionals and to prevent any mismanagement that can be seen when organising events, etc. Knowing also that the pioneer stage in architecture and urban planning can be qualified as a success, I think that the time has come to consider other professions

still critically lacking in the Kingdom of Cambodia. We will be here to assist in building a reflection in fields besides architecture and archaeology, although they all relate to each other.

Our office would like to pay tribute to the outstanding work of Pascal Royère on the Baphuon temple; 14 years have been dedicated to rehabilitate the monument within its context. I personally consider that the harmony has been up to now perfectly respected and that it is in the eye of the beholder. Of course, there are recommendations to be made but the work is outstanding. We also pay tribute to the work of Mr. Jacques Gaucher on Angkor Thom, who through a lot of self-commitment is carrying out important and difficult research. Let's also mention the successful coordinating work of Mr. Michel Verrot, urban planner and chief architect of the State, who has been in Cambodia for many years and managed to coordinate several initiatives in the fields of heritage and architecture; the continuation of this work would be desirable. Besides this, we would also like to pay tribute to the work of Mr. Lablaude who, since 1992, has been advising on issues regarding conservation of historical monuments.

We would like, Mr. Beschaouch, the ICC to carry out a specific work on the memory of the ICC. Many documents have been accumulated since 1993 and we realise—Mrs. d'Orgeval joins me in this assessment—that this work deserves to be exploited, showcased and disseminated. It is circulating through a group of experts, and now researchers are in need of this work. Therefore I think that it is important to start leading a reflection on the memories of the ICC since the Tokyo Conference, to know how and where to keep these documents, to have a documentation centre and also to showcase the activities of our Cambodian friends in the field of training. This is because they have also accomplished many actions with the international teams, but there is a lack of communication and assisting and advising the communication of APSARA should improve this.

Thank you Ladies and Gentlemen for your attention, I hope that we have made up some time."

**III.4 Banteay Srey Parvis, by Mrs. Chau Sun Kérya, Director,  
Department of Cultural Development, Museums, and Heritage Norms,  
APSARA National Authority**

"Honourable Deputy Prime Minister,  
Honourable Co-chairmen,  
Excellencies,  
Ladies and Gentlemen,

I would like to thank the Deputy Prime Minister, who trusted me and gave me the resources to complete this project which I must admit frightened me when I was appointed. I thought and still think that it is a difficult project but as it had to be done, the work has been completed. I would also like to thank the General Director, who always showed support, all the relevant Departments of the APSARA National Authority, the local authorities and especially thank my young team and single out one individual who was one of my student and to whom I entrusted the coordination; You Chantha who really deserved being trusted.

The APSARA National Authority expressed the wish to develop hosting facilities to offer better services to visitors and to showcase the prestigious monuments of the site of Angkor, inscribed in the UNESCO World and Humanity Heritage List. Priority development focused on the parvis in front of the major and most frequented monuments. The first parvis development has been on the Banteay Srei site, which I am presenting to you now.

[slide] I would like to remind you that two presentations on the design of the parvis and a third on the visitors' circuits inside the temple have already been presented during the

ICC in the technical sessions. <sup>[slide]</sup> This development results from a bilateral cooperation with Switzerland: here is a picture of the signing ceremony to mark this cooperation.

The project will be in three parts, firstly the spirit and goal of the project, the implementation stage and the operation.

<sup>[slide]</sup> The APSARA National Authority aspired for a parvis respecting, to the highest degree, the environment. The newly developed spaces respect the authenticity of the place, buildings of vernacular style are integrated and the vegetal essence comes exclusively from Cambodia. <sup>[slide]</sup> The local population is also integrated, with areas dedicated for the selling of local products.

<sup>[slide]</sup> The Banteay Srei parvis has been designed to showcase the monument in its natural environment, and to allow visitors to enjoy this green environment while benefiting from hosting facilities as soon as they arrive on site. Thus, a road bypassing the temple was built, to reroute heavy vehicles driving to the north-east of the country and which used to pass directly in front of the main entrance of the monument. Then a study to assess the development of the monument and of its environment was carried out in order to enable visitors to better understand the spirit of the place and its Khmer cultural features.

<sup>[slide]</sup> Objectives of the project: the design of the Banteay Srei parvis revolves around two distinct zones harmoniously related to one another:

The zone of the parvis is the hosting area and includes the following facilities:

- ♦ parking, where visitors disembark in front of the visitors' centre and cars then park among trees and gardens;
- ♦ at the visitors' centre, the necessary information for enjoyment of the visit is available; there is also a small bureau de change and a nursing room for emergency treatment. Then they can go to the cloakroom to leave items unnecessary for the visit, such as backpacks. This is an important feature as many people bring backpacks and when visiting the temple, these backpacks rub the stone facings. They can also buy items for the visit (plans, maps, water) and then start walking towards the temple, passing by the ticket booth.

The parvis area serves also to regulate the flow at peak hours. Visitors can wait in a pleasant environment while the amount of visitors in the temple diminishes, and to better enjoy the visit they can shop or visit the interpretation centre or have a drink on the shaded terrace of a café facing the grandiose, peaceful Phnom Dei.

The temple and its surrounding areas are also comprised of a landscape environment, mainly forest. All natural elements are rehabilitated with the greatest care: water is again a main feature and *trapeangs* (natural water bodies) are natural emblematic places. <sup>[slide]</sup> The formerly unattended agricultural land has been replanted so that the site, and in particular the rice fields, are revived. It is also an opportunity for the visitors to appreciate local life and to understand the major role played by rice, which is vital for the region and the country, and to integrate the local populations into the project.

<sup>[slide]</sup> Preliminary studies on archaeology, hydrology and environment were carried out, as were tourism, social and cultural researches. CMAC checked that the land was previously and correctly cleared of mines, and then a census of the shops in front of the temple was taken. These shops will be relocated in new dedicated areas on the parvis.

<sup>[slide]</sup> The implementation stage was supervised by <sup>[diapo]</sup> the steering committee of managers and decision makers from the Swiss and Cambodian sides. Then a technical committee made of young technicians of the Departments worked together to apply or implement the decisions.

<sup>[slide]</sup> The *ad hoc* experts in conservation and sustainable development also visited the site twice.

[slide] The implementation stage carried out by the APASARA National Authority:

[slide] The first action was to acquire the land [slide] and then to develop the paths, access infrastructures and the commercial area. The access structures included bridges, platforms and footpaths. [slide] Then the construction of the parking and hydraulic systems started. [slide] The circuits already designed were tested: 35, 45 and 55 minutes long depending on the time tourists have or can spend. [slide] The cultural and natural landscapes were also taken into account through landscape development.

[slide] Works carried out by the Banteay Srei Conservation Project (BSCP) from Switzerland:

The visitors' centre, which facilities were mentioned earlier, then the interpretation centre were built. [slide] The setting up of a World Heritage Plaque was also organised, located on the rehabilitated historical axis from the temple to Phnom Dei, and along the path to the temple a world heritage marker was also set.

[slide] The soft opening of the temple parvis was inaugurated officially. HE Sok An the Deputy Prime Minister and President of the APSARA National Authority, the Ambassador for Switzerland, Mr. Imhof and Mr Yai, the President of the Executive Council of UNESCO honoured the ceremony by their presence. [slide] Here is a picture of the official delegation which ventured onto the path for nature-loving visitors.

[slide] Works to be completed before the effective opening:

- ⇒ Continuation of the development of open spaces: trees, lawn and a third rice field planting; development of landscape paths in the commercial area and the surroundings of the monument.
- ⇒ Construction of the return paths towards the parvis after the temple's visit and of additional rest rooms in the area of the parvis.
- ⇒ Redesign of the tested circuits based on data collected by our team of the Public Observatory.
- ⇒ Design of the information and orientation panels inside the parvis (parking, shops, etc.) and of signs bearing tree names.
- ⇒ Relocation of the shops once the new area is completed, as for the moment only the construction of the new shops has been completed.

Thank you for your attention."

### **III.5 Sustainable agricultural development, by Dr. Tan Bun Suy, director, Department of Agriculture and Community Development, APSARA National Authority**

"Excellency Deputy Prime Minister,  
Honourable Co-chairmen,

The intergovernmental meeting of November 2003 at UNESCO in Paris recommended that the APSARA Authority see to a sustainable development of the Angkor Siem Reap Region.

When sustainable development is mentioned, one always thinks about sustainable development for tourism, about the preservation of water and forest. But sustainable agriculture did not draw the attention it deserves.

Nevertheless, the population of the Angkor Park's, which is the base for intangible heritage, main livelihood comes from agricultural resources. Siem Reap's tourism boom triggered a massive demand for food products which may create an ecological disaster, as in order to meet this demand agriculture production is intensified through traditional means such as the use of chemical fertilisers and pesticides. Chemical agriculture cannot meet the

expectations of sustainable development. Siem Reap is located within the Tonle Sap watershed, and deposits from 'chemical' agriculture will pollute the Tonle Sap, its fish and consequently consumers all over the country.

When our Department was created in 2004 we decided to follow a sustainable agricultural development approach. Our reference was bio- agriculture, which created a lot of skepticism among our colleagues, as we know that bio agriculture regulations, even in Europe, are not yet clearly set out.

We faced this challenge against all odds and were supported by HE Mr. Sok An, Deputy Prime Minister and President of the APSARA Authority. We would like to take this opportunity to pay him a vibrant tribute.

Bio-agriculture required research which within five years resulted in the implementation of new, pro-environmental agricultural techniques. Presently these techniques are considered as models for Cambodian agriculture. The Minister of Agriculture came to Siem Reap to show his support.

## 1. Agronomical research

The following points were researched:

- Composts,
- A new natural stimulant KEM (Khmer Effective Microorganisms),
- The mud of the Tonle Sap,
- The new technique to cultivate rice: the system of rice intensification using natural resources (SRI)
- Natural pesticides.

All these points were experimented with: as I mentioned these techniques are new and needed to be tested.

### 1.1. Composts

Our Research aimed at improving the composting process: raw material used, KEM to increase the fermentation speed, improve qualities.

### 1.2. KEM

[slide] KEM means: Khmer Effective Microorganism. They are human friendly microorganisms and are Khmer as all the goods used to make them come from Cambodia.

Our activities are to:

- study their efficiency on vegetables, rice, chicken, fish, and cultivated mushroom.
- control their quality.

When converting from chemical agriculture to bio- agriculture, the yield of the farmer will decrease. But the combined use of the compost with KEM improves the yield of the organic farm and mitigates the loss, and we have been catching up on chemical agriculture. Our farmers know that the use of chemical fertilisers is damaging the soil and by using bio- agriculture the soil improves year after year and plants are better able to resist parasites, therefore providing safe food for consumers and sustainability for farms.

The soil of Angkor is very sandy and fragile. The megalopolis settled on a forest. The reserves accumulated by the forest are running out rapidly, and according to Zhou Daguan the Khmer of Hindu faith considered the edges of the moats as impure. Zhou Daguan was surprised that this area was disregarded, as it was widely used in China. Thus, Angkorian soil impoverished rapidly causing the fall of the yield, despite the hydraulic control. Therefore the fall of the Khmer empire was mainly due to the natural poverty of the Siem Reap soil, which should be amended.

The modern agricultural technique that we have set up, based on the use of composts, of KEM, of deposits from the Tonle Sap and of the SRI, allowed for a two-fold, even three-fold increase of the yield, without using any chemical agro-inputs, at least in our research station. <sup>[slide]</sup> Here a picture of farmers making KEM which then will be transferred into plastic cans. <sup>[slide]</sup> Here are the greenhouses where pot crops for vegetables take place <sup>[slide]</sup> and here is the field experiment. <sup>[slide]</sup> There is also a small laboratory to observe micro-organisms. <sup>[slide]</sup> The most spectacular effect was on chickens. The poultry farm chicken is the main profitable resource for farmers. With the use of KEM, the mortality among chickens decreased, especially during the shoulder season. <sup>[slide]</sup> When a chicken is treated using KEM, it lives longer. This efficiency was also demonstrated on fish and humans. I myself tried it and so did one of our distinguished members of the ICC here among us.

<sup>[slide]</sup> This is the yield improvement for mushrooms. <sup>[slide]</sup> Here is the SRI and in detail the resources used to increase the yield two or three-fold. <sup>[slide]</sup> Here a farmer using this new system and row crops with promising yields.

The Tonle Sap mud: we studied its physical and chemical components and tested their efficiency in the fields <sup>[slide]</sup> Here are some samples taken from the Tonle Sap and different types of heavy, malleable and compact sediments. <sup>[slide]</sup> The yield: over 20t/ha; the yield is doubled.

<sup>[slide]</sup> Natural pesticides have yet to be proven efficient, with the exception of tobacco juice. We thought that *Neem* oil might be promising.

<sup>[slide]</sup> Our first results were disseminated by our agricultural extension officers. We focused our activity on model farmers who extended the use of the composting of KEM and SRI. <sup>[slide]</sup> Saving groups were formed among farmers; there is a total of 24.

One of the issues of bio-agriculture is the lack of raw materials; livestock will have to be considered for the farm, as will the recycling of urban waste. An exchange programme was held with Japanese experts on KEM. Some areas around the Baray will have to be used, although these are lands which are undergoing real-estate development. Regarding the Tonle Sap sediments, we need to carry out an impact study before extracting in larger quantities. For natural pesticides and the use of the *Neem*, we are hoping to rely on the support of an expert from India.

There are also land speculation issues causing landless families to relocate in urban areas. We propose the setting up of zoning. This means an area reserved for forest, another for agriculture and a third for building. Finally, the last item is on economy. After 30 years of war, Cambodia cannot compete with its neighbours, as we face many problems. The cost of agricultural products remains high although the quality of our products is better than those of our neighbours. We must then limit the import of foreign products and control their quality. Thank you for your attention."

## GENERAL DISCUSSION

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*Comment from Mr. Beschaouch:* "I would like to say that as usual I listened intensely to my friend Mr. Bruno Favel and I would like to add that, within the framework of this mission, as defined by himself, and regarding training, we should start and the earlier the better, towards management. In particular the management of museums, as with relation to world heritage, the key word is management and museums are starting to appear so we need people who know how to manage in this country. So do not forget this point in your training. As for architecture, I recall that there is already a unit at the architecture department which for many years has been used to what is called tropical architecture and so on. And maybe it would be a good idea if they start taking an interest in the architecture of this

town, as much damage has occurred due to lack of knowledge. Driving through the town of Siem Reap will show you the scope of the disaster. So please, I would like to recall that five years ago, HE Mr. Sok An, President of the APSARA Authority twice said that Khmer architecture should be promoted accordingly. But there is a need for experts, personnel, etc. And it is still not too late, so please help us if you can. Two more things: congratulations to Mrs. Chau Sun Kérya. I personally followed the project and as secretariat we held two coordinating meetings with the Swiss team, and I must say that this is remarkable work and that we congratulate her once more. Finally Professor Tan Bun Suy is someone who really never let go and who never forget to recall that, even if no one believes in it, he is pursuing his goal and will continue. What he said on the need to fight against the soil running out, etc: I don't know if we can elaborate on the end of the Khmer empire due to the depletion of soil, but it is a possibility. This was also a theory elaborated for the Roman Empire. I would like to congratulate him and also say to those who might be for the first time attending this meeting: you should not be surprised by the fact that agriculture is on our agenda, as if this was a farmer's convention or for agricultural development. Agricultural development occupies an area where out of 40,000ha, 30,000ha are cultivated areas. Therefore it is vital to support the farmers who have settled here, 100,000 people live now on the World Heritage Site and have been for many years. These 100,000 individuals should be assisted. He will continue his research and I believe that our ICC will grant this issue the importance given to it by the Royal Government. Thank you for your attention".

*Question of the Co-chairman for France:* "I would like to have confirmation of my understanding of Professor Tan Bun Suy's last intervention. When talking about his agricultural method is this method for bio-agriculture or is it a stage towards an agriculture which could be labelled as appellation of origin? If we start with the appellation of origin, we enter an economic process, which in the long term would bring foreign currencies and wealth into the region. I would like to have further explanation on this subject knowing that an appellation of origin might be successful."

*Answer from Mr. Tan Bun Suy:* "thank you for this important question. I think we are going towards labelling. It already exists in Cambodia: the CEDAC Group had created an organic label for bio labelling, thanks to the help of our German friends. Also GTZ is working on regulations on labels".

*Comments from Mr. Pierre Grard:* "again regarding the last intervention of Mr. Tan Bun Suy, I would like to stress that when sustainable development is mentioned, this can only be achieved if farmers living around the site of Angkor can make a decent living while at the same time tourism brings in easy money. There will not be any development of the sustainable kind, if the discrepancy is too large between people earning their livelihood from the land and those benefiting directly or indirectly from tourism. This is what I wanted to add on this point."

### III.6 TRAINING:

#### **a. Second session of the Regional Heritage Training Center (Cambodia, Laos and Vietnam), by Mrs. Sisowath Chandevy, director and Mr Sylvain Ulisse, coordinator of project activities**

#### **Mrs. Sisowath Chandevy:**

"Excellency Mr. Sok An, Deputy Prime Minister, President of the APSARA Authority, Honourable Co-chairmen, Excellencies, Ladies and Gentlemen,

I would like to introduce the second session of the regional heritage training centre under the tutelage of the Ministry of Culture and Fine Arts and in collaboration with the French Embassy in Cambodia.



The centre started in October 2007, and has been operating for almost two years. It works in partnership with the *École de Chaillot* and has trained Cambodian, Vietnamese and Laotian professionals in conservation, restoration and development of built-up heritage. These training curricula offer to the young experts studies on the protection of monuments, city quarters and their surrounding areas and also restoration and development projects, whilst including the constraints linked with the rapid development of tourism. The aim is for the students to acquire skills in project management, project ownership and domestic political administration.

Once the training is completed, the students return to their work, mainly in ministries or for public institutions in charge of protecting heritage, such as APSARA, the Ministry of Culture or local authorities. The centre is organised into several committees. The first is the general steering committee, which meets once a year in Paris and is co-chaired by the French Ministry of Foreign Affairs and the Ministry of Culture and Communication. This committee selects the candidates and steers the main guidelines of the centre's curriculum.

The second committee is the local joint coordinating committee, present in three countries. This committee approves the programme content, identifies teachers, instructors and / or lecturers, creates a shortlist of students and provides monitoring of the training programme.

Excellencies, Ladies and Gentlemen, may I now switch to Khmer for the presentation with slides.

[OrigK] I would like to introduce you to the Regional Heritage Training Centre. The activities carried out in the centre are composed of two fields: the first field concerns architecture where temples and buildings are studied. The second field deals with the urban where open and built-up areas and landscapes are studied. A third of the programme is dedicated to lectures and seminars, another third to fieldworks and the last one to long term projects. The lecturers working with the centre and with the *École de Chaillot* are Professor Pierre André Lablaude, here among us, in charge of the architecture field, Mr. Alexandre Mélinos in charge of the urban field and Mr Michel Verrot the senior professor in charge of the operation of the centre. Experts from the three countries, Europe or Asia give the lectures. Two places of studies: the first one in Siem Reap at the Angkor Conservancy concerns the architecture field and the second the urban field is taught in Phnom Penh in the premises of the Ministry of Culture and Fine-Arts.

Mr. Lablaude is in charge in the curriculum of teaching heritage concepts, the history of architecture and the aspects regarding construction techniques and materials, the conservation and maintenance of the buildings and the potential risks on buildings and their repair. Regarding the urban field focus is on studying the structure of the city, its evolution (how it changed and what is the difference in these changes), the ancient city, the methodology to analyse ancient cities, the study of landscapes and public spaces, on damages, on illegal constructions and on construction codes.

During the sessions experts of the three countries (Laos, Vietnam and Cambodia) are invited. The heritage diversity of each of the country is here emphasised on. [slide] Moreover, conferences are held by experts from teams working in Angkor as seen on this slide.

[slide] The fieldworks include site visits such as at the Baphuon introduced by Pascal Royère on restoration techniques or the Ta Prohm or the Bakong where the pagoda was also looked at.

Adding to lectures are half day or full day short-term exercises as defined by the lecturers. Over the course of a year, two or three exercises are practised per fields. These exercises enable to assess how the students have understood the lectures. [slide] For example the measured drawings of the Wat Enkosei pagoda in Siem Reap, or exercises on the damages of the Bakong temple, and on loads and restoration techniques. Exercises pre-

pared by Professor Pierre André Lablaude. Other exercises focusing on the urban field in Phnom Penh were carried out for example on houses around Psar Thmey and their construction codes.

I would also like to mention the long-term project, of importance for the training given. These long-term projects are selected by the students when they file in their application. The field concerning the urban or the ancient villages around the temple are defined later on.

The lecturers dedicate much time to the control and correction of the students' homework.

The long-term project is divided into four sections: the documentation, the analysis, the damages and restoration. <sup>[slide]</sup> Here are examples of the documentation for the project of Laos students on the repair and conservation of the Wat Phu temple, here of the Vietnamese students from Hue and of Cambodian students on houses near the Royal palace. <sup>[slide]</sup> The second section: the analysis of the architecture and urban context. <sup>[slide]</sup> The third section on the damages including a mapping of them. <sup>[slide]</sup> The fourth section on the restoration proposal, here showing emergency and secondary measures. The students are evaluated according to a 60 per cent mark allocated to the long term project and 40 per cent to short-term exercises. The long term project marking includes a monthly assessment and a final exam.

22 students attended the first year in 2007-2008 of which eight were Cambodians, nine from Vietnam and five from Laos. Out of 22, 18 graduated, four received a certificate of attendance, as they obtained insufficient markings to be graduated. This year, the second, there are 21 students, nine Cambodians, nine Vietnamese and three from Laos. The final exam will take place late June. The graduation ceremony will be held on July 2 and 3, 2009. The first year the ceremony was organised under the high Presidency of Her Royal Highness Norodom Bopha Devi, High representative of King Sihamoni attended by HE Véng Sereyvuth Senior Minister and former Minister of Culture and Fine Arts and HE Mr. Jean-François Démazières, ambassador of France to the Kingdom of Cambodia.

I will now give the floor to Mr. Sylvain Ulisse regarding the possible application of the training for the city field. Thank you."

*Comment from the Co-chairman for Japan:* "may I point out that the allocated ten minutes have ran out following the presentation, so perhaps Mr. Ulisse could present as briefly as possible".

### **Mr. Sylvain Ulisse:**

"Excellencies,  
Honourable Co-chairmen,  
Ladies and Gentlemen,

Just to add a few words on the career opportunities given by the regional heritage training centre in Cambodia. Of course we have the APSARA Authority with the Angkor site and the Ministry of Culture and Fine Arts, with sites such as Banteay Chmar.

I would also like to mention the non-Angkorian heritage with the *mission du patrimoine* (heritage mission) a cooperation project started in 2005 within the Ministry of Culture and fine Arts, and made up of a small team of architects and archaeologists. Its vocation is to carry out studies and inventories. The inventory established by the APUR in 1996 is the starting reference for understanding the heritage value of monuments and to resituate them within their urban context. Beyond the study there is also the will to dis-

seminate knowledge through conferences and exhibitions in order to raise awareness among both the general public and the authorities. Consultancy is also part of our commitment with restoration sites and the drafting of a protected plan for three historical quarters of Phnom Penh: the main post office square, the central market area and the Royal Palace neighbourhood.

I will also mention the complementarity between both institutions: the team working for the *mission du patrimoine* train or trained with the regional heritage training centre; three students last year and another three this year. The training centre brings the methodology essential for works of the *mission du patrimoine*.

Here is an example with this shop house located on street 130 in Phnom Penh and which has been studied by one of the students as part of her long term project and indexed within the framework of the *mission du patrimoine*. It is now under restoration, starting with the roof.

I will end by simply saying that better knowledge of Phnom Penh's urban heritage would allow for a better consideration of it, and that this heritage will only exist through its recognition. It is therefore vital to promote or recognise it to the local authorities. Thank you."

### **b. Czech Republic School of Restoration at Phimeanakas temple, by Mr. Michal Blazek, Czech Project in Angkor**

[OrigE] "Excellencies,  
Co-chairmen,  
Ladies and Gentlemen,

I am a representative of the Czech Restoration School. The Czech Restoration School recognises 'restoration' not only as saving the stone, but also as the rehabilitation of the quality of the plasticity and the aesthetic, social and religious significance of statues. In Czech we have two words for conservation and restoration: the term 'conservation' is used for the action of saving artefacts for museums; 'restoration' is for inside or outside. One must make a decision on considering Angkor as a Museum or as a 'real' place.

[slide] The restoration of the lion at the Phimeanakas: the lion was found on the ground. The lion is the real guardian of the temple and represents the spiritual values of the temple. [slide] The cracks on the stone were filled with a boring engine from within as we see here after reprise. [slide] The missing pieces of the pedestal were replaced by stones from the Beng Meala quarry with the help of Khmer sculpture.

[slide] After finishing restoration, one leg was missing so we replaced it with new stone. But after the rainy season we discovered the original missing leg, [slide] so, the original was put back into place.

[slide] The second lion restored was that from the south, which was in the worst condition. The sculpture was split into seven large pieces that were held together only with the support of a rusty armature; remains of hard cement damaged the stone. [slide] The damaged surface of the stone was cracked and flaky and had vertical fissures due to the poor selection of stone years ago. So it was removed. [slide] Mechanisation can be compared to similar work which was done in Angkorian times.

[slide] Lichens: it is important to point out that some lichens are water repellent, and very good at it. But they never spread all over the surface, so it is impossible to say if lichens are positive for the stone as they only partly cover the stone surface. [slide] Inside the pedestal was a pool-like opening that had been filled with water over a long period of time,

with no evaporation possible. The base had been for many years subjected to chemical and physical changes, as the part affected is harder than the rest of the stone.

[slide] Parts of the sculpture were then removed and relocated to a more suitable place for restoration. Everything was documented, measured and cleaned. The pedestal was left in place and was cleaned by streamer. [slide] We had trainees from APSARA. Water was desalinated and reinforced by a consolidation solution as the stone in this part was of bad quality.

[slide] The difficult part was to connect everything in one go instead of piece by piece. [slide] We used bonding agents on mineral base and I know that in Angkor bonding agents on epoxy or silicate based are used: this is the first time on a mineral base. This is cement without salt, which has nothing in common with the concrete of bad historical reputation.

[slide] Another picture of the trainees; we had to leave and we came back in May, when we glued inside the lion. Then Khmer sculpture was used to make the décor of the new parts of the artificial stone.

[slide] This is the lion of the north side. The stone was replaced from one of the quarries. The cracks were particular as they were vertical and not horizontal. It was a minor restoration of holes to clean them.

[slide] There was a two- day workshop at Phimeanakas with monks from all the Siem Reap Wat. They cleaned with brushes and water two lions under my supervision. And now you can see the contrast between the lions rehabilitated as sculptures; they are not only for pictures, as they have real values as guards.

[slide] This shows you a lion half buried in the ground which was then cleaned. It presented cracks. Thank you very much."

**c. Achievement report IV on international cooperation for cultural heritage education strategy, by Mr. Nobuo Endo, Honorary Fellow, Sophia University, Japan**

[OrigE] "Excellency,  
Co Chairman,  
Ladies and gentlemen,

This is a summary of education training from 1998 to 2009.

In Japan two kinds of programme were implemented:

- 1) From 1998 to 2009, forty Graduate students of the Royal University of Fine Arts (RUFA) studied at Sophia University and Nihon University. Eight of them succeeded in earning doctoral degrees, and 16 obtained master's degrees.
- 2) From 2000 to 2008, Sophia University recommended graduate students of the RUFA to the Kanagawa and Tokushima Prefecture as trainees, in order to acquire technical skills and museum management which I think is very important for Khmers. A total of eleven were trained in heritage conservation techniques and 3D skills.

In Cambodia there were six programmes:

- 1) From July 1990 to March 1995, Sophia University dispatched a lecturer, M. Takahashi to the RUFA, for the purpose of curricula such as Khmer history, Art history, and Heritage management, in the Departments of Archaeology and Architecture.

- 2) The Sophia Angkor Mission implemented intensive sessions at the RUFA from March 1991 to May 1997, a total of 1500 students participated in these sessions. It was then turned into a UNESCO programme.
- 3) Training at Banteay Kdei temple and at the Sophia centre. A total of 600 students have participated in these programmes.
- 4) For the transmission of Khmer traditional techniques, skills training were implemented from 1994 to 2007, for 15 stone-workers and 30 workers selected from several villages in the Angkor area, for the conservation and preservation work at the western causeway of Angkor Wat.
- 5) Regarding heritage education programmes for the local people: from 1994 to 1997, site-visits to the Banteay Kdei temple were implemented twice for people of the North Sra Srang, Rohal, and Kravan villages. In 2008, visits to the Banteay Kdei temple, the western causeway of Angkor Wat, and the Preah Norodom Sihanouk-Angkor Museum were implemented twice, for villagers of the North Sra Srang, Rohal, Kravan and Wat Po villages, representing a total of 250 people.
- 6) "The International Cooperation to aid Cultural Heritage Education Strategy" has been implemented since 2006. It is a four-year programme sponsored by the Ministry of Education, Culture, Sports and Technology of the Japanese government. This programme is for graduates of the RUFA and Sophia University. The trainers were Japanese and Khmer researchers. The programme is composed of both fieldwork among the Angkor monuments and sites and lectures at the Sophia Asia Centre. It is meant for the training of conservators, researchers, and engineers, with reference to cultural heritage. It lasts 25 to 40 days per year. A total of nine specialists appear per year, both Japanese and Cambodian; a total of 15 under-graduate and graduate students per year of the Royal University of Fine Arts and Sophia University, Tokyo; Fieldwork at the Angkor temples and lectures at the Sophia Asia Centre for Research and Human Development.

[slide] This picture was taken in 1993 on the campus of RUFA. In this room there are many of our ex-students, who are now experts. [slide] This is training for local people on the Preah Norodom Sihanouk Museum and Banteay Kdei temple. [slide] This is also international cooperation on heritage and conservation strategy.

Handover is also very important. I want to stress that management is very important, as are conservation, survey and maintenance. But Sophia is here for a handover. Everything needs to be transferred to Cambodia for the Khmer people. Thank you."

## GENERAL DISCUSSION

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*Information point of Mr. Warrack :* [OrigE] "If there are no questions I would like to make a brief point of information because I am here with ICCROM and we wanted to tell His Excellency Mr. Sok An and the Co-chairmen about what we are doing and how we are proud to be part of this all training process. We are here to carry out two meetings and to launch two programmes which were announced at the last ICC: the first one concerning collection and the other Preah Vihear.

On the collection programme we did a national activity last October and now we are preparing a regional activity open to all ASEAN countries. We are here to gather information from all our colleagues, with whom you also worked for many years. As M. Endo pointed out, many of the experts now here were our students, and we are very happy to have been part of that process for such a long time and that some of our students have even overtaken us. This is how we want to continue. And we would like to stress that we have just signed an agreement with the National Authority for Preah Vihear to begin the planning of a major training programme, which will be carried out very much in collaboration and with the assistance of everybody who is here. Because we do not want to reinvent the wheel, we don't want to come here and say this is your training programme. We want to use the resources that are here, listen to the opinion of people because everybody as an opinion here. But we have been working for so long that it is easy for us to listen. So we are here

for the next week and we will be contacting everybody on a very informal basis in order to begin the process of gathering information so that we can create a long training programme that will reflect the needs of everybody concerned. We are looking forward to this very much. We signed the paper today so we can start tomorrow. Thank you very much."

### III.7 ENVIRONNEMENT

#### **a. Report: International Symposium on the Present Situation of the Environment in Angkor Park and Surroundings, by Dr. Shinji Tsukawaki, Kanazawa University, ERDAC Team (Environment Research Development Angkor Cambodia)**

[OrigE] [OrigE] "I would like to thank UNESCO for giving me such a long title. To summarise a symposium in ten minutes is hard so I will be brief. [slide] We had one symposium in Siem Reap and a seminar in Phnom Penh in March to open our results of environmental survey research in Siem Reap and Angkor area. We are an international mission between Japan and Cambodia to evaluate environmental pollution and destruction. We wanted to open our data to the public and extend our knowledge on atmosphere, forest and water.

[slide] We would like to thank the strong support given by these organisations. My first visit to Cambodia was in 1992 and I have observed a lot of changes in the environment here. [slide] I established a research team called ERDAC for evaluation. [slide] These are our objectives and the composition of the team. We work on atmosphere, forest, water (river), soil, and fresh water consistence. We also have a team monitoring the ecosystem of the Tonle Sap.

I will skip the presentation and introduction for time reasons. The environment of Cambodia was created 6 000 years ago and we can expect that it will change in the future. So the standpoint is important for environmental history and future change. We have had four presentations on atmospheric science and environment. [slide] The first, by Dr. Okumula, he has an observation system in Siem Reap with data he has been collecting for four years. At the symposium and seminar he presented his results and gave his ideas for a future real-time monitoring system of the weather. [slide] Regarding air pollution we heard a talk from Dr. Furuuchi on the air pollution in the Angkor area. He worked hard with APSARA and recognised a clear relationship between traffic and air pollution. He also detected probable emission sources in Siem Reap: exhaust, generators from hotels and so on. He interviewed many locals, hotel and restaurant employees on the way they use their generators, etc. and asked their opinions on air pollution. He also gave a talk on air pollution in Phnom Penh. [slide] This indicates the change in air pollution in Phnom Penh, in red is the daytime pollution, and in black at nighttimes. Strangely enough, pollution is higher at night than during the day, maybe because pollutants are more numerous from private houses rather than from car exhausts.

[slide] The final talk was by Dr. Tan Bun Suy but as he is among us I guess it is easier to ask him directly so I will skip this part. [slide] Then we had five talks on water environment: one by Dr Hang Peou who is the leader of ERDAC on the Cambodian side. I am sure you had many opportunities to hear his talk so again I skip. [slide] But there is one great thing he did for the symposium which was his selection of lunches; we have had great lunches, so we seem to have discovered a new talent. The second was on the water quality of the Siem Reap River by Dr. Oyagi. [slide] He traced all areas of the Siem Reap River during four years and he recognised a great change of quality depending on the rainy or dry seasons. He also did preliminary search on the water quality of the western Baray, carrying out scanning of the water quality in these areas.

[slide] Then we heard from Dr. Ishikawa, a specialist of stability and primary producers. [slide] This is the oxygen of the Siem Reap River, upstream and downstream, and stability. He can recognise high oxygen and high stability around the city of Siem Reap. They are

trying to provide a basic evaluation of the water environment, not pollutants themselves. [slide] The final presentation on water was by Dr. Motomura, a specialist of Southeast Asian fish, and he recorded 8 species in 8 families from the Angkor Wat moat. He made beautiful postcards and I have several free available: if you wish to have one, just let me know. [slide] He also recognised these exotic fishes in the Tonle Sap which come from South America. This one looks like a piranha, but please don't worry it is not: it is very similar in shape, but do not confuse them. They are very suited for the environment of the Tonle Sap, so maybe piranhas will come soon.

[slide] Regarding river engineering, Dr Takebayashi made measurements and sampling of the Siem Reap River near Spean Thmor (Spean Takev) where there is the most meandering. [slide] He tried to estimate the river change by one dimension formulation. [slide] This is by Dr. Takahara, who studied the strength of the soil in the monument area. This study was carried out together with the Institute of Technology of Cambodia (ITC).

[slide] Forest environment: Dr. Hirabuki worked on the Preah Khan monument where restoration is taking place. He and two other researchers designed a poster of plants and emerging trees in Preah Khan and also of the spatial arrangement of the forest with the monuments. [slide] And also was carried out a landscape, forest and ecological evaluation of the landscape and the monument to produce an example of reforestation of the area.

[slide] Then I gave a small talk about three Cambodian families: one from Chong Kneas, one from Kampong Pluk and one from Pradak in the eastern baray, to understand how they adapt to the real natural environment of Cambodia. These families live on water near the forest.

[slide] Sorry for skipping so many points. Conclusion: we should hand the natural environment of Cambodia over to them. I don't like to use the phrase sustainable development. Sustained is a little bit negative and defensive; we should create an environment among them in real harmony and an environment for you. As we cannot control the environment we must create a harmony. Our activities in these areas are completed. But we are planning a second phase of the research. We must work much more in the application field and not only in the research field. Thank you very much."

## GENERAL DISCUSSION

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*Observation from the Co-chairman for Japan:* "the environment is a major component and we intend to talk about sustainable development although, as we have been told, the word sustainable might not be the right one for talking about supported development. I would like to open the floor for discussion on the topic of the environment and the subjects presented by ERDAC. You are welcome to ask questions or make comments."

*Comment from Mr. Beschaouch:* "I listened carefully to this paper, as it is a large team and there are people within it whom I know well. We should congratulate ERDAC for this study and we are certain that it will benefit not only the city but also the park and the core of our concerns about the Tonle Sap basin. I would like to tell you, Mr. President, that it might be a good idea to wait before opening the floor, as we will listen to the experts in sustainable development and the report presented by Mr. Goto is on the same topic so maybe we could relate both subjects. I will only ask two brief questions. The first might show my ignorance: how did a fish from South America manage to reach these shores? It is hard to imagine as it is so far; I admire the fish. Unless some clever tourist wanted to play a nasty trick on the locals and introduced that fish to the lake. The second question: I am sure that ERDAC is in contact with the newly-formed Tonle Sap Basin Authority, whose President is among us. It would be useful for both of you to get in touch as I know that you have already established close relations with the APSARA Authority and the town of Siem Reap."

Answer from Mr. Tsukawaki: <sup>[OrigE]</sup> “regarding the second question, yes we would like to share our information with the new Tonle Sap Authority though I don’t think we will work that tightly with them. As for your second question on the fish: in Thailand and southern Vietnam they keep this kind of fish in rivers to sell to Chinese, Taiwanese or Thais because their meat is delicious, although I never tasted it. Around ten years ago I saw many piranhas in a market in Phnom Penh, so maybe some of them went from the shop to the river and arrived in the lake. You know there is a new species which bears my name so I don’t like to have piranhas there. Our fish specialist says that the piranha is not a dangerous fish, it has a small mouth and cannot bite people, although it sounds very bad.”

Comment from Mr. Pottier: “I would like to react to this report, will you publish the proceedings of this colloquium and will they be available?”

Answer from Mr. Tsukawaki: <sup>[OrigE]</sup> “you mean the results of the symposium. Yes we will the examination is not finished yet but after we will publish.”

Comment from Mr. Beschaouch: “please do not forget the secretariat when you send copies of the proceedings, thank you”.

Comment from the Co-chairman for Japan: “Mr. Beschaouch made a suggestion and I agree I think it would be good to discuss the environment after the report from our expert Mr. Goto. For those who want to make remarks or ask questions please wait for a moment and you will have the floor.”

### **III.8 Project for annual international festival of music, art and culture within the Angkor temple complex, by Ms. Zhivile Montvilaite and Mr. Prim Phloourn, Angkorica, Rise Entertainment Group, Russia**

#### **Ms. Zhivile Montvilaite:**

<sup>[OrigE]</sup> “Excellencies,  
Ladies and Gentlemen,

I am Zhivile Montvilaite. I represent the company “Rise Entertainment” and the project “ANGKORICA”. Most of you remember that we came two years ago to present the festival.

Many things have happened during 2 years:

- We are working closely with APSARA Authority, taking advice about locations and the spirit of the place.
- Getting advice from UNESCO.
- The support from HE Mr. Sok An, Deputy Prime Minister and chairman of the APSARA Authority.
- The support of the Ministry of Culture of Cambodia.
- The Angkorica Festival project is supported by the Ministry of Cultural Affairs of the Russian Federation, the Committee of State Duma of the Russian Federation on Foreign Affairs and the Ministry of Foreign Affairs.

“ANGKORICA” – is an annual cultural event / festival, unique for popularising Khmer culture. Following two years of extensive research into the cultural and historical features particular to cultural heritage preservation at the Angkor Archaeological Park, we have made substantial revisions to the geographical locations of events proposed for the festival.

We have abandoned the proposal to arrange any festival events on the territory of Angkor Wat temple. We have revised plans to stage any events on the territory of Angkor Wat in recognition of its unique status as a living temple because of the spiritual and ritual events which take place there on a daily basis. Angkor Wat shall be left for purely individual



observation for all visitors.

Following careful consideration of the transportation routes inside the complex, road capacity and the sizes of existing parking places, we have cancelled the idea of staging "Apsara Dances", as well as a night carnival in Angkor. For the same reason, a Gala Show seems impossible to organise on the territory of the complex. We have divided the events into groups and located those groups in various parts of the complex during each day of the festival. A number of considerations, which in any way contradict the spirit of Angkor, have been excluded from the programme or substituted by more relevant ones.

Substantial changes have made to the music format of the festival. Music to be performed at Angkorica would mostly be of a meditative and ambient style. Additionally, folkloric music and presentations will be creatively mixed with soft, modern, intellectual music. Any performance by any artists would not be a replica of their existing stage shows but would be an absolutely exclusive one-of-a-kind performance designed especially for the Angkor and Angkorica festival, following the unique history of Angkor and Khmer traditions and customs. Interactive theatre and art presentations will be more focused on the history of Angkor.

All Pop, Rock and Rap music projects are to be excluded from the festival play-list. Club music would be a part of an off-festival programme (it has been moved to Siem Reap town).

Here I am going to draw your attention on some professional equipment. Stage and audience equipment could come from aluminium modules produced by Layher, a famous German company that specialises in professional stage construction. These modules are able to accommodate considerable weight; they have all the elements necessary to smooth and or skip obstacles as well as the safest joint mechanisms, which are exceptionally safe and well constructed. Besides the aforementioned, the Layher systems are constructed in a way to avoid vibration and therefore avoid contact with walls and columns. This professional stage equipment is the only one which complies with the international safety standards to protect the monuments from damage and make the performance absolutely safe for both artists and spectators.

There are L-Acoustic speakers (produced in France). V-DOSC systems provide vertical sound direction that avoids low frequency vibration without quality loss and distortion. V-DOSC systems are usually used for events held in the areas of ancient monuments, glass buildings, etc.

Safety boards would be built on venues where it is necessary to protect the visitors (danger areas) or to prevent ordinary visitors from reaching certain areas (technical zones, archaeological excavation areas, etc.). As already mentioned, after two years working together with the APSARA Authority, the project was modified. Several locations changed. Following is the list of the locations where we would like to hold the festival events in the current version of the project:

[slide] The Bayon will be the main stage for theatre-music-dancing performances. The North side of the Bayon temple is the stage, and the audience is to be seated opposite this stage. [slide] The area behind Baphuon will be used for meditation and spiritual practice and is the second location. It is anticipated that no sound or any other equipment will be used at this location. The visitors will be seated on mats.

[slide] The zone of two ponds in the territory of the Royal Palace will be used as a 'chill out' zone with a small stage for day-time performances by oriental folklore artists. The zone in front of the Terrace of the Elephant is the biggest stage for the event. This is a huge, attractive space for a main performance where everybody could meet. However, we will probably avoid this location for the first year's festival: it could be very useful for the second year.

[slide] Srah Srang and Banteay Kdei – as a sound installation and chill out and lounge place with small stages for day time performances. Neak Pean – as an evening visual-sound show stage. [slide] The road from the South gate to the Bayon – dedicated to small performance on the road itself.

But let me come back to Bayon Temple as a much more sensitive example. Knowing the difficulty in arranging a stage at the Bayon we decided to modify the original stage into a smaller one, using only some technical lighting and projectors inside the temple. And we have decided to reduce the stage by using only the Bayon Temple as background for the stage, with a very light scale and light constructions. For the audience we will make sure that all spectators will use traditional Khmer mats inside different zones, using different colours for each zone. Transportation: all cars and buses will be parked on the esplanade of the Terrace the Elephants and everybody could walk to the Bayon Temple.

I just want to say that over the two years working on the project we tried not to use Angkor's image for the festival but tried to create a festival which can help to show off Angkor. Let me remind you that "Rise Entertainment Group" (trade marks: Rise Music, RISE LIS'S) has been awarded various international and Russian national awards related to the show business industry. It was also given special gratitude and recognition from the President of the Russian Federation. Rise Entertainment Group specialises in creating major festival brands. Thank you for your attention."

### **III.9 Report from the *ad hoc* group of experts for sustainable development, by Messrs. Jean-Marie Furt, Tetsuji Goto and Pierre Grard**

#### **Notes on the *Angkorica* Project, by Mr Jean-Marie Furt**

"This section of the report of the *ad hoc* expert group on sustainable development is the outcome of a study on documents previously provided by the ICC secretariat. Some of these documents differ slightly from the presentation you have just seen. Therefore the report is predicated on the documents we worked on.

The project raises a few ethical, political and governance issues that we are presenting here with relation to this project but which could be applied to other entertainments or situations.

Should a World Heritage Site such as Angkor host entertainments to attract more visitors or different types of visitors, or should we consider that the attraction of the site stems simply from magical or sacred features? And if a decision is taken to allow this entertainment, how should these activities be developed in order not to damage the site? Then if we start marketing the site, how to prevent these entertainments, firstly considered as solely accessory, becoming vital and the site turning into a venue?

We cannot answer political or ethical questions but we can shed light on the technical sides of the discussion. We will make two initial comments:

- we are here facing a problematic regarding the need and scope of an event to be repeated and developed.
- It is above all a commercial event which must return a profit thanks to the fame of the site—it cannot be organised anywhere else—but it must also be financially viable by receiving a large audience (this is not an entertainment for a happy few by invitation only; this is more like culture for the masses).

We can already highlight some of the project's qualities and also make observations and ask questions. Let's start with the positive aspects of the project: they come from the exceptional characteristics of the project itself; the word *exceptional* must be understood here as in *an exception*. The shows will take place once a year, over three days, within a

very well defined area and time frame; this should on assumption limit the impacts on the site.

The high profile of the artists considered for the event is also an asset. According to the names presented on the CD (artists such as Christo, the Royal ballet) it seems that some of the planned schedule may attract an audience of enthusiasts, therefore in symbiosis with the mystical features of the site.

The project also plans to install light equipment: such as removable and reversible wooden and aluminium constructions (stages, platforms, and amphitheatre), in order to preserve the site.

Nevertheless, to stage such an event infers marketing, even if it is limited, and the organisation of the show raises some issues. Those regarding the place: shows will take place in zone 1; some in daylight, others at night. They will mainly affect the temples of Bayon, Angkor Thom, Banteay Kdei, Neak Pean, and Srah Srang.

To refresh our memories I would like to mention the Royal Decree of May 28, 1994 which provides for:

- Article 8, to limit development of this zone,
- Article 20, to limit and regulate visitors' access,
- Article 11, to authorise for tourism purposes as little development as possible,
- Article 19, to forbid any commercial activities on the site.

At a time when some development projects are in the making, it is important to recall the power of these mitigating principles quoted in this decree.

The second series of questions is directly related to the founding principles of sustainable development: the social and environmental aspects. Firstly, will not this event, organised in January, increase the environmental pressures on the site? Maybe it would have been better to plan this event towards the end of the season, but the profit might be less, and, as mentioned earlier, we are dealing here with a business.

Then, a more generic question which can be applied to other project: what will be the consequences for the local population: in terms of employment and training and also, financially? On this point the organisers of the project only plan to employ Cambodian musicians and actors, but they do not go into detail.

The third series of questions is on economic aspects and space management. These are simple questions dealing with logistics. How will the flow of visitors be managed? How will the organisers ensure the safety of visitors at night? Will the monuments hosting an event be closed to the public and reserved only to ticket holders? Will the entrance fee be cheaper for those who do not wish to see the show? Of course further questions could be asked.

The fourth series of question focuses on the direct impacts on the site, on the monuments and on the archaeology and the image of the place: when reading the documents, the operation of this event requires such logistics that if it is not properly managed it might cause damage to the temples. For example:

- the installation of spot lights, speakers, screens (6m high), Wi-Fi on some sites and cabling system.
- the construction of an amphitheatre with a capacity of 3,000 seats and a stage resting on the stones of the temple, according to the plan sent.
- the building of a commercial area, which even limited in size, might introduce a risk of turning the site into a 'Disneyland', something which shall be avoided at any cost.

After these observations and the several questions raised, we will make two recommendations:

The first on the project itself and, in particular, we recommend the promotion of the cultural aspect with relation to the business approach and therefore to:

- only use one site to hold the event,
- only authorise the scheduled theatrical performance, subject to obtaining all guarantees regarding the safety of the place and the number of spectators authorised;
- ensure that no structure, even of light design, shall be directly touching the walls and stones of the temple.

The second recommendation focuses on tourism development of the Angkor site. Even if tourism activity is down, this is not the reason to agree to anything and kill the goose with the golden eggs:

- to promote constructive projects with direct benefit to the population (for example the project to develop the Siem Reap canals which was presented during the last two ICCs, and the positive progress of which can be seen on the panels located in the hall).
- On a business level, to work towards promoting the whole territory rather than just the site. This morning Mr. Beschouch, as an archaeologist, talked about the symbiosis between the town and the territory. Nowadays, in terms of development we carry out the same type of analysis, which is that the territory and the city must irrigate one another and, to continue with the hydraulic metaphor, although a little trivial, I would say that the town should not siphon off the territory.

Lastly, it would be of interest, and it is pressing, to start a reflection on tourism development and on the restrictions of the development of heritage as much for the town of Siem Reap and the Angkor site as for all of Cambodia."

## GENERAL DISCUSSION

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*Comment from the Co-chairman for Japan:* "thank you Mr. Furt for these very relevant considerations. I now open the floor for discussion on this project and especially to the teams in charge of restoration and conservation of the affected temples."

*Comment from Mr. Claude Jacques:* "I only have one word to say. I have the project in front of me and I am horrified by the project at Neak Pean and I do not understand how someone can imagine something like that. That is all I have to say."

*Comment from Mr. Bruno Favel:* "two years ago I made observations and stressed my concerns. I am now even more concerned when I hear that the Bayon would be used as a stage. Let me remind you that in Tokyo in October 1993, ethical rules were set out for Angkor Wat; these were very stringent, so that our Cambodian friends would be able to master tourism development and prevent turning it into Disneyland and a marketing product. I then repeat what I said two years ago: Angkor is a sacred site and this project does not respect at all the 1972 convention which [Mr. Favel mumbles]—I am sorry I am outraged—provides for the respect of the authenticity of the site. There is no dramatic change if Angkor Wat, the Bayon or Angkor Thom are turned into venues. I have nothing against entertainment; the issue is not to mix the profane and the sacred, but to use the word marketing and to include a genre which is not adapted to this site. I think that the World Heritage Committee would send you some strong notifications, although there is worse in the rest of the world. What I want to say is that the sacred feature of Angkor is never mentioned in this project. Where is it? I share completely Mr. Claude Jacques outrage."

*Comment from Mr. Bouchenaki:* "I think the problematic should be considered on the level of principles. The site was inscribed simultaneously on the World Heritage List and on the List of the World Heritage at risk. For ten years the Cambodian authorities have made an effort so that the site would no longer be considered as a World Heritage site at risk. I fear

that we might commit to operations which will have an impact on the monuments. Our role as an International Coordinating Committee is for safeguarding *and* development of course, but foremost for safeguarding. I think that it is very important to continue with the stance which enabled the site to be inscribed on the World Heritage List as the Cambodian authorities met all the requirements of the World Heritage Committee so that it would not be considered as a site at risk and that when any operations occur to promote the site's fame and development, these shall be implemented with a complete respect for the safeguarding of the monuments and above all of the site. This message shall be clearly conveyed when dealing with a site of this magnitude, as is Angkor".

*Comment from Mrs. d'Orgeval:* "I just would like to support what has been said as the spirit of the texts and of the place shall be respected. If not, then things might be drifting and ultimately go overboard, and there is a time when one should know when to stop".

*Comment from Mr. Beschouch:* "may I talk as an individual and not as secretary, as I do not have the right to write down what we are being told, and I have been, for 50 years, an archaeologist and a manager of my heritage in Carthage, which has been inscribed on the World Heritage List since 1979. So I would like to say three things: firstly I fully share Professor Bouchenaki's viewpoint that the World Heritage Convention shall be respected. We have sufficient issues to deal with, and next year a report must be sent. HE Sok An, the Deputy Prime Minister, invited our Committee to assist in its drafting to get the best report possible. So let's not now take a new risk. The issue of endangerment needs to be raised. And I will speak frankly in front of this technical, scientific and cultural assembly. We are victims of our success. When something succeeds, then people get jealous: this must be said. Some people bear a grudge against Angkor because it has succeeded: this must be said. Personally, I have no ties with any administration in the world, so I can be frank. Cambodia is focusing attention all the time to delay its progress, so people say 'let's not assist in doing this'. Let's try to reach harmonious development and to help the representatives of the APSARA National Authority and of the Royal government to well-manage this site. My second point is the following. Let's take examples throughout the world. Worldwide entertainments, visits, animations, etc. are organised. What I call entertainment is in the meaning of beauty, and not the trivial meaning, for example the Grand Musical Fountain Display in Versailles. In Carthage there is also entertainment, at the pyramids as well, in Verona, but we need to agree on the word entertainment. It is not throughout the year and not every week, they are organised in periods chosen over a year or certain weeks. Professor Lablaude can say for how many days per year in Versailles, and the conditions of this entertainment. So there are entertainments but they are submitted to conditions, to a set of specifications. We need to remain balanced. We do not close the door on projects but we need to take precautions. My third observation is the following: we have two things in operation: excavation works at the Bayon, an extraordinary large working site, complicated by the fact that five teams work in Angkor Wat and in Ta Prohm; therefore, almost all the temples are undergoing restoration work. So we have to be careful. One cannot, at the same time, carry out safeguarding and restoration works and stage a huge event in the same location. We have to strike a balance. And if I were to be asked as a former heritage manager and a man of heritage I would say 'maybe'. The three experts whom I laud presented a report of the highest standard, so let's begin with what they have proposed. We start with the theatre play following a set of specifications. The outcome is analysed. If the show succeeds by following the precautions then we can go further. But let's not drift as said by Mrs. d'Orgeval and let's not put the site under conditions which some malicious people could then use to threaten and put at risk. So let's open the possibility but we must remain strict in our controls. This is how we will succeed in our task as advisors to the Royal Government. Thank you for your attention".

*Comment from Mr. Sahai:* <sup>[OrigE]</sup> "I would like to say one thing. Firstly I would like to save Bayon from this proposal. Bayon should never be mentioned as a background of any spectacle because Bayon is the biggest spectacle created by Khmer artists in the world. It will never be repeated. It is unique in the world and I can assure all the Cambodian authorities that it is such a great spectacle that up to the end of the world it will receive a great number of tourists and visitors. Please discuss this but never ever mention Bayon as a

background for any spectacle because this is the greatest spectacle created in the history of the Art of Mankind.”

Comment from the Co-chairman for Japan: “I think that we are far from reaching a consensus on this subject with clapping on both sides. What was said and argued does not allow me to see more clearly. So a proposal and recommendations were made by our *ad hoc* experts. I believe that we all agree to add the recommendations of our experts to the recommendations of this technical session, which will be presented during the plenary including the discussions we had and the recommendations from our *ad hoc* experts. This is a proposal: if anyone has any other idea please take the floor, I would like to listen to them.”

Comments from Mr. Beschaouch: “I put back my hat as secretary. In agreement with the whole secretariat we back your proposal if there is no objection we adopt to our level not a plenary session decision but a consensus reached by the committee to be presented to the Royal government, the report of the experts, and later, when we have approved the recommendations of the ICC, these recommendations will then be presented to the plenary session so that they will be implemented. So we keep a record of what has been proposed but later on I will repeat it for the record if there is a consensus. And if someone here, before I present the recommendation, objects or is gripped by remorse, it must be clear for all that he /she shall take the floor, so that it will be kept definitely for the record. Thank you for your attention”.

Comment from the Co-chairman for Japan: “I would like to add one thing. Everything which was said here is recorded and will be transcribed on the next report of the secretariat. So every word is recorded and the recommendations are one thing, but what was discussed will allow the plenary to better understand the context of this project.”

## **b. Safeguarding and Development of Siem Reap Town, by Mr. Tetsuji Goto**

[OrigE] “Good afternoon, His Excellency, Ladies and Gentlemen.

[slide] It is an honour to attend this ICC technical session. Today, I would like to make a small report regarding “The issues of Urban Development of Siem Reap Town” as one of the ad-hoc experts for Sustainable Development.

[slide] Firstly, why do I report the problems of the Town area today?. The relationship between the Heritage Area (especially Zone 1 and Zone 2) and Town area is most important for Sustainable development. Most tourists stay in the Town Area. There is mutual effect between Historic site (Zone 1 and Zone 2) and Town area. Of course Zone 3, along the Siem Reap River side, is in the Town Area. If one site is damaged or suffers negative impacts, other will also.

[slide] Now, due to increasing Visitor numbers, urbanization is growing rapidly. According to the population Census of 2008, Siem Reap Town’s Population is 172,843. From 1998 to 2008, one decade, this has almost doubled (1.7 times). Compare with Cambodia’s Urban Total Population: the annual Growth rate is 2.55 %, but Siem Reap’s is 5.20 %. As for visitors: in 2004 there were almost 500,000, in 2009 1 million, which means that this figure has doubled in 5 years. Therefore, some problems have arisen: environmental, insufficient infrastructure and disordered and rushed development without proper control or management.

[slide] Now Siem Reap’s Provincial Government has established a technical committee, which discusses town issues. What are those issues? Firstly, environmental issues are concerned; such as water quality, ground water, solid waste, air pollution, noise Disturbance and Natural Resources.

[slide] Picture 1; in the rainy season, the main streets are flooded. The ADB has an on-going sewage project and the AFD drainage project is also in progress. [slide] Picture 2; there are many street vendors along National Road 6 and other main roads; they may cause waste disposal and block traffic movement and may contaminate (pollute) the area, [slide] Picture 3; there is much garbage in the drainage system, which damages neighbouring areas and unpleasant odours.

[slide] Waste disposal is also a concern of the Provincial Government; there is much illegal dumping. Back to the street vendors, there are many waste disposals. A private company is collecting waste and cleaning public areas, but people are saying that this activity is not enough.

Rapid Urbanisation and many tourists bring environmental effects, but the local government does not grasp the situation. People say there are environmental problems, but we do not have enough information. Now the Technical Committee of the Siem Reap Provincial Government is in discussions to start conducting some studies on this issue.

[slide] Insufficient infrastructure: rapid urbanisation and the rushed development of hotels, guest houses and commercial complexes increasingly impose heavy burdens on the existing local infrastructures; traffic congestion, for example: near Psar Leu on National Road No6 there is traffic congestion, and at the French Bridge during rush hours, although it is one way. In the central area there is a shortage of car parking areas. Car parking occupies the sidewalk and blocks pedestrians. Motorcycle parking is in the same situation. Other problems are: water supply, electricity, sewerage and solid waste management etc.

[slide] Many shopping complexes, apartments and condominiums are planned or under construction, but there are many vacant offices and some construction has been stopped. This problem is not new. Many large old apartments are also vacant. There is no proper control or management. In the future, these buildings may collapse or damage the neighbouring areas.

[slide] Landscape: according to Royal Decree 001, Zone 3 is protected cultural Landscape, but there are no guidelines or regulations for this. For example, there are many billboard advertisements along the Siem Reap River. Moreover, according to the Provincial Department of Land Management, Urban Planning and Construction, in the Central Area, building façades should follow the French colonial style. But there are no design codes or criteria. People do not know what French colonial design means. For example, this picture is of Canada Bank in the Central area. This may not be French Colonial Style.

[slide] Regarding Landscape, Urban Heritage is an important issue, although Siem Reap's Provincial Government does not know exactly what APSARA is doing on Urban Heritage Development. It is important to share the information widely. The APSARA Urban Heritage Development Department is expected to lead this issue.

[slide] This picture was taken near Royal residence. The Grand and Victoria Hotels are near the Royal Gardens. This building, the Victoria hotel, looks like it is in French Colonial Style. But next to the Victoria Hotel, the Shopping centre is of a different style. Next to the Royal Residence, a large building is under construction. Apparently this is a shopping centre. I am not sure if APSARA and the developer had any discussions regarding this building and landscape but this building should consider harmony with other, traditional styles. If in this area modern styles appear, the landscape may be damaged.

[slide] Land use plans are the most important tools for controlling and managing development. There are two land use plans for Siem Reap town. One is for the construction of buildings in the Town Area (called Sub-Decree 35) and the other is the land use plan of Siem Reap town. Sub-decree 35 was prepared by APSARA and revised in 2004 but has not been authorized yet. On the other hand, The Land Use Plan of Siem Reap Town has been prepared by the Siem Reap District office (Siem Reap Municipality) with the Ministry of Interior and the Ministry of Land Management Urban Planning and Construction, with the

Provincial Government and APSARA as members. This project comes under the Asia Urbs Project supported by GTZ. This also has not yet been authorised. So now we have two plans and neither of them has been authorised. Under this situation, it is difficult to control development and building. It is necessary to provide land use plans and building regulations officially. The provincial Government does not know what the situation is regarding land use; is it authorised or still under discussion?

[slide] Local Government also plays an important role in sustainable development. His Excellency the Governor is among us and the Siem Reap Provincial Government has already established the Provincial Democratic Development Committee and Technical Committee for discussion of development issues. In May, the Provincial Council was established. I am not sure of the role of the Provincial Council, but there is also an important factor: discussion of sustainable development is not only for international national experts, but also for local government officers. It is important to set up a mechanism to establish cooperation between local government, national government and international organisations together.

[slide] My recommendations:

1. To grasp the environmental situation and real problems. The technical Committee of the Province discusses studies. It is important that the local government, APSARA and other bodies are aware.
2. To revise land use plans and building regulations as needed, and coordinate authorisation
3. To make guidelines and regulation for the landscape and façades of building. APSARA should lead this issue, especially the Department of urban heritage development. It will be expected to disseminate this information widely.
4. To announce this regulation widely, as the people have not received any information or guidance. When I ask people if they know if there are guidelines they say 'yes', and when I ask what they are they say 'I don't know'.
5. To tackle and share the information between local government, national government and international organisations

Moreover, it is most important to share information within local governments. The ICC now debates on sustainable development and of course our governor and people here are aware of it as they attend. But other directors and people should also be invited. Thank you for attention."

## GENERAL DISCUSSION

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*Comment from the Co-chairman for Japan:* "I make a remark on the last recommendations from Mr. Goto, which is on the issue of collaboration between the ICC and the local authority. I think that the example of the creation of this working group would be the opportunity to talk more about these issues. If I am not mistaken, among members of this working group there will be technicians and managers. This then is an example in the field of water, keeping in mind that this is a vital sector for the environment. And it would be good if other fields would follow suit. I would like to raise awareness of this working group, composed of civil servants, and of the work that we will carry out with this group."

*Comment from Mr. Pierre Grad:* "regarding urban planning issues, something came to my mind which is that UNESCO has already abilities in that matter if we look at the work carried out in Luang Prabang on the quality of life and the development of the town. Maybe Luang Prabang could inspire us to limit damage, in particular in the ancient town".

*Comment from Mr. Azedine Beschaouch:* "I here would like to speak on my name and as a witness. Firstly, I would like to make an observation on the presentation of our colleague on behalf of ERDAC, which was so clear that we can link everything together. Here you see that research carried out by a group of scholars from a University with Japanese expertise is cross-referenced with the expert group and the report from Mr. Goto, and this is what is



of interest. We must face the challenge; this is not a private analysis but the reality. So, on the predication of this reality which in reports is called an assessment, we must put forward measures to the Royal Government.

This is not to mitigate some of the sad aspects that were presented but to report the truth. For more than one year some efforts have been undertaken between the APSARA National Authority and the local authorities' departments under the aegis of H.E Mr. Sou Phirin, Governor of Siem Reap. I attended some meetings; this is the reason I can testify. I went to town to visit, with the experts, the canals and to see some of the works realised on the river banks, etc. There was also an outdoor exhibition to show all works implemented. This does not mean that problems have disappeared but rather that solutions exist and that, with will and coordination, we will succeed. This work seems satisfying as two years ago the Mayor of Paris, a Tunisian like me, invited me to a conference on heritage and development organised with the International Association of French Speaking Mayors (*Association internationale des Maires francophones*, AIMF). I was in Hue and I noticed that special funds had been allocated to Siem Reap town and that this budget was renewed two weeks ago to the day. HE Sou Phirin received a letter, and I know this because I keep in touch with the AIMF General Secretary. A grant of 380,000 Euro was allocated for the first stage of a two-year programme aiming at fighting urban pollution along the river banks and embellishing the town. This is so that the town reverts to what it was 20 years ago, with blossoming gardens and space because this is diminishing. So, there is hope and the possibility of better development.

We have among us HE the Governor and he is the person in charge of the region and of all the departments at the governmental, regional and local levels. Using the words of our Co-chairman Mr. Naruyama when he mentioned the success of this working group on water, which after four years, as presented by Mr. Delanghe, is finally operational. So with the authorisation of both of you may I propose to the Governor as a recommendation of our committee the creation, soon, the earlier the better, of a working group on Siem Reap town to protect its cultural heritage and to promote tourism, to protect its natural heritage (canals, vegetation, river banks, etc.) so that they benefit tourism. Because do not forget what H. E. the Deputy Prime Minister said at the start of the conference, that there is a world economic crisis but we shall not be using as an excuse. The town lacks in animation and attraction. To be frank, after visiting the temples what do tourists do afterwards if there is no open space and leisure? So I propose to form a working group and personally, as secretary, I am ready to work under the supervision of HE the Governor if he agrees and with my colleagues, among them the *ad hoc* experts on development who are ready to come earlier before the ICC, I know this because I asked them yesterday. UNESCO, France and Japan, who are financing us, have said that there was enough money for them to stay a couple of days longer. So, we, the secretariat, can work with the AFD and JICA experts and with all those working here and bring to the ICC our expertise in sustainable development. They will dedicate a day or two to working on this topic and I am sure that we will succeed. So if HE Mr. Sou Phirin agrees, we will restudy this topic and the secretariat and I will objectively analyse all these issues in order to put forward some solutions. Thank you for your attention."

*Comment from Mr. Jinnai:* <sup>[OrigE]</sup> "just to follow up from the presentation carried out by our ad hoc in development M. Goto and also what was mentioned by M. Grard in Luang Prabang. I have information on an excellent experience we had in Phnom Penh. We had organised a seminar on conservation of urban heritage in 2006 which was shared by His Excellency Deputy Prime Minister Sok An and we also received strong support from His Majesty. It was a two-day very pro-active debate and I think there is a follow-up. We produced recommendations and of course it is a very sensitive matter because it does not involve only one municipality but also many other government institutions such as the Ministry of Planning, etc. As Mr. Grard said we have one sector among five UNESCO sectors which is called the Human Science sector. And this is really a sector that we have to work on and I am really happy you mentioned this and also I am very encouraged by Mr. Beschousch. And there is an example already which is a very new organisation or working group: the water colloquium. The fourth meeting just finished a few days ago, at the be-

gining there were hesitations but now we are really catching up and we know where we are heading. So maybe at the next ICC let's not wait longer: we can get in touch with the Committee mentioned by Mr. Goto and contact it through him. And I am sure the governor agrees about UNESCO involvement in another field in Phnom Penh."

*Comment from Mr. Azedine Beschaouch:* "Mr. Maruyama reminded me, and I recall it to our assembly, among which is HE Dr. Thong Khon, Minister of Tourism, that in March there is a meeting organised between experts and also ongoing work between the UNESCO office, the ICC secretariat and all Ministries. The information is being disseminated because, as said Dr. Thong Kong and also HE Sok An, there is not only an international crisis, there are also structural reasons and what Siem Reap town has to offer must be streamlined and amplified. This might be done on the governmental and regional level and we can join them. So, in the presence of the head of the Cambodian delegation HE Sok An, of the chief of Tourism Mr. Thong Kong and of the Governor, would you agree to create this working group so that all the questions raised may be analysed and solutions proposed? And when we come to the ICC, we will bring not only an analysis but also reports on operations and proposals, thus playing our role."

*Answer from Mr. Bun Narith:* "with the authorisation of my President and of the Governor, I may add that we fully support your proposal and that we will do our best to participate and collaborate with your idea as suggested during these debates".

*Answer from Mr Beschaouch:* "thank you very much. We will implement this recommendation and I am delighted that on behalf of UNESCO, the Head of the Phnom Penh office Mr. Jinnai has confirmed that we will also turn to the large field of human sciences at UNESCO which could, with expertise and ideas, enlarge the opportunities to source financing and which could assist in the implementation. Thank you for your attention."

*Comment from Mr. Thong Khon:* "I would like to inform you that in early 2011 we will organise the Asian Tourism Forum, for which the government would like to organise a joint ministerial committee to prepare for this event. Maybe HE the Deputy Prime Minister could chair this committee".

*Comment from Mrs. Tep Vattho:* "I would like to add something to Mr. Goto's presentation. I am the director of the Department of Urban Development of the APSARA Authority. I listened carefully to Mr. Goto's report and I thank him for mentioning all the urban planning issues which Siem Reap is facing. The same problems I also showed in November 2007. Since then a lot of work has done with the few resources available. All the allocated budgets are not invested solely in the town; it is for the whole country. We try to safeguard the hydraulic legacy such as the Siem Reap River. In 2007, with financing from AIMEF, we sanitised and embellished 3.5km of the Siem Reap River's banks. Previously these banks were used as public lavatories and dumps. We sanitised and developed a River promenade of 3.5km along the River. Regarding the colonial market, since 1997 we have been giving to the builders and to those requesting them, the plans of the façade of shophouses. We have not had the time to draft a regulation but we hurriedly drew the facades and asked the builders to construct them identically. Inside the buildings the builders are allowed to develop their own styles adapted to the modern way of living. Since 1997, we have managed to rescue 17 shop houses, although rescue is not the right word as at the time at the rear of the market square there was a car park and shophouses. Thanks to our plans of the façades given to the builders, the parking cannot be seen anymore and harmony is restored. We managed to rehabilitate the southern facade of the market. On another facade which was a rice warehouse we succeeded in building ten shophouses and a few days ago I sent a document on this subject to Mr. Goto. This to tell you that documents exist and that the town is making efforts to try to remediate all these urban planning problems".

*Comment from Mr. Sok An:* "usually Mr. Co-Chairman I don't take the floor during the general discussion. But this time I ask to take the floor, as this is an important problem. It concerns, simultaneously, our partners; also the provincial authority and the government. This urbanisation issue is a sensitive and complicated one. It is a social, cultural, and eco-

nomic phenomenon, and one which is highly politicised. I knew since the early days of APSARA that the Authority had made an effort with our friends to draft a governmental decree on urbanisation. But it was very unqualified and modernised, whereby an ideal town was portrayed and we faced strong opposition from the Siem Reap residents. This is the reason this decree was suspended. I am delighted that our experts have raised the problem of the urbanisation of the town of Siem Reap, as this town's population is now at its peak, having reached 170,000. This is, then, a strong growth of population and we must provide a solution, which must both be agreed on *and* technically meet the requirements of the solution, and also be adequate for and accepted by the Siem Reap population. This problem has to be dealt with by the government and that's the reason I am delighted that your expert has raised it, as we think it is highly sensitive but important. We therefore need a text of reference to address the situation. And I share the proposal of Professor Beschaouch, as when I was listening to the presentation on urbanisation problems I said to my colleague the governor that a working group should be formed. We then had the same ideas; this one has been expressed and I share it. We need a working group gathering all stakeholders and discussing the drafting of a new plan to be agreed to by all. As when it will be approved it will firstly affect the residents and there are some strong reactions to be expected. So the discussions will be more detailed, will take into account all parameters and I hope that we will reach a consensus on a new plan approved by all. Thank you for your attention".

*Comment from the Co-chairman for Japan:* "I think that the discussion can be concluded and we can take a break before continuing with the miscellaneous items and the recommendations".

*Comment from Mr. Azedine Beschaouch:* "this also leaves some time for the secretariat to complete the recommendations; they will be ready in ten minutes."

## IV- MISCELLANEOUS ITEMS

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### IV.1 Points of information

#### a. Prehistory exhibition at the National Museum in Phnom Penh

"I will be brief as we have already dealt with some points. With respect to the National Museum exhibition, this was already discussed extensively by Mr. Pottier, so I can only congratulate him again. On a domestic plan or here in Angkor, it is beneficial that some venues can accommodate cultural and museography exhibitions, which are innovative, as they reach the general public, before publishing books for specialists resulting from scientific and detailed researched. We are delighted about this and I congratulate the APSARA National Authority and UNESCO, which contributed financially to the exhibition and as said by Mr. Pottier this morning 'money is the sinews of war' and not only for an exhibition.

#### b. Opening of the Tani ceramic museum

This was the object of a presentation from one of our Japanese colleagues. I will only add two points regarding the content and date. With respect to the date, instructions have been given by the Deputy Prime Minister for the Museum to be ready by the next plenary session. We will then have to organise ourselves to get to the museum located on the edge of the World Heritage site. I have already been on site as I followed this operation with the Japanese and Cambodian teams. Regarding the content, cooperation with the Department of Preventive Archaeology added ceramics which were not found on site, where there are kilns; these are items found in Angkor and which will be used for comparison purposes. This is a very good museographical point in highlighting the trade exchanges with the rest of Asia, not only regionally but also as far as China, etc. So remember Excellencies, when the date of the next session is given, to be ready for the opening of the museum.

### c. Safeguarding the forests and cultural landscapes at Angkor

If there are in this room two individuals who at the level of our ICC pushed for this question not to be only on the agenda but also translated into action, these two people are our Co-chairman, Mr. Maruyama, and I. The Royal Government, through the action of HE the Deputy Prime minister and President of APSARA decided to establish a special Department in charge of managing the forest, the environment and the cultural landscape. This is because this landscape is part of the 40,000ha of this World Heritage Site, hence a report presented by our colleague and head of Department, HE Mr Thanat. And many of us expected more from this report, as they were waiting for more detailed requests. So dear colleague Mr. Thanat, many of us here and not only the French and Japanese Embassies would like to know what the APSARA Authority and this Department are expecting: expertise, financing, books, etc. you need to inform us. So this point of information is to remind the APSARA Authority and our colleague Mr. Thanat and his collaborators to prepare a solid file in French and English to inform the international community and to transform this point into cooperation.

Three more things: the first is a book published by the Government. HE the Deputy Prime Minister made a wish and this wish was to convey knowledge on Angkor into the school curriculum. So not only do we work on Angkor, but we also inform children so that they can become the future conservators and protectors of this national heritage. This process starts at school. These wishes turned into instructions, and let us congratulate His Excellency, as this does not happen often, on seeing wishes turned into concrete actions. So it is now a book and it has been given to us. It is a colouring book with instructions for the teacher in order for the latter to explain and organise a visit to various places (temples or museums). Education must be interesting, as children must not get bored: this book fulfils this role. This is the first book of its kind, and let me praise the individual in charge of this work HE Mr. Khuon Khun Neay, who was 30 years ago the dean of the faculty of architecture. As a former dean he has the educational abilities to conceive of such a book. He is the author of this work, and we thank and congratulate him. He also did the groundwork to get sponsoring from the International federation of UNESCO clubs and associations in Japan. This Association, I remember, once gave us a cheque for Angkor for US\$100,000, when we were in Japan with Mr. Van Molyvan in 1995. It came from people who came and contributed. It is a very active and intelligent Association. They sponsored this first book and committed in sponsoring the second one, so again congratulations to the actors of this operation.

The second point concerns the July issue of *National Geographic Magazine* with an illustrated article on Angkor and specifically on the Greater Angkor Project from Professor Fletcher regarding *water management and the urban complex*, which are fundamental questions for understanding the history of Angkor and its management issues. Let's congratulate Professor Roland Fletcher: I will rush to the newsagent to buy this issue, as I cannot wait for a free copy, and I will ask Professor Fletcher but I am sure that he has already thought of it, to send several copies to the APSARA National Authority to make available this excellent information and dissemination work. This is the most effective way to disseminate information throughout the world.

Last point: this morning HE the Co-chairman for France, Mr. Desmazières, went to a private and moving ceremony on the tomb of a great conservator from 1906 to 1916: Jean Commaille, if I am not wrong. He was a scholar who was murdered, as at the time the conservators were themselves handing out the pay to the workers or Grabbing a ladder, so you see how nowadays things are much happier as the conservators have everything, although some people still complain. Commaille died in tragic circumstances and to commemorate this, a stele was erected to highlight that in the background of individuals fate it is the safeguarding of Angkor and of Heritage which is at stake. This stele mentions the conservators since the presence of the EFEO until independence, and even later, as Bernard Philippe Groslier stayed until 1956-1957. There were a total of six conservators, representing a long history. So I hope that this stele will inform visitors of all nationalities about people who

spent part of their lives in Angkor, among them the Great Marchal who was recalled after the war and stayed here until he was 76 or 77. Also to commemorate, UNESCO, in agreement with HE the general Director Mr. Matsuara, is preparing a book on the 15 years of service to the safeguarding of Angkor; this is the history of our ICC. I would like to ask the four veterans to contribute to this book, I am number four and the oldest, and the three others are among us: Mrs. Francine d'Orgeval, Bruno Favel, Mounir Bouchenaki and I were in Tokyo for the founding conference in October 1993, and we are the only attendees remaining. Tokyo to Paris, all our ICCs, we are still here and there will be a small text to recall our numerous souvenirs of these founding moments in Tokyo. This is all I had to say on these information points."

Comment from Mrs. d'Orgeval: "thank you for giving me the floor a few seconds, I would just like to talk about the issues of the environment and that during the plenary session last December H. E. Mr. Thannat presented the activities of his newly created Department of cultural management of forests and the environment. He took this opportunity to ask the international community for assistance. He submitted a file and when we came back to France, we filed it with the National Institute for Agricultural Research (*Institut national de recherche agronomique*, INRA) and I believe that this body is interested in starting cooperation. Earlier Mr. Grard, who replaced Mr. Houillier, and is a botanist, mentioned that he was available to carry out an assessment mission of the Department's requirements, which could then turn into cooperation. So we did not forget the request made at the ICC."

Comment from the Co-chairman for Japan: "thank you for this very encouraging mention, the floor is now back to Mr. Beschouch for the recommendations."

## V. RECOMMENDATIONS OF THE ICC

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### V.1 Presentation of the Recommendations, by the Standing Secretariat

#### Mr. Azedine Beschouch:

"I would briefly like to start with recommendations expressed during the plenary session: we have adopted a series of recommendations, several of which have been turned into actions, such as on Mount Kulen, as mentioned today, the western baray and with regards to Siem Reap the works carried out as mentioned by Mrs. Tep Vattho. So the only remaining point is the inundated forest. We are waiting for the government's instructions to continue our commitment to support the conservation of the inundated forest in relation with the Tonle Sap Authority, following the visit of a UNESCO expert Mr. Ishwaran Director of Ecological and Earth Sciences. Another expert came from Jakarta, where the UNESCO office for Sciences in the region is located. Both focus on the safeguarding of this region and of the inundated forest. So we will act as soon as the government, represented by HE Mr. Sok An, the Deputy Prime Minister, gives us guidelines. But we are satisfied, as all recommendations were followed up by all the teams and by the APSARA National Authority.

So let's pass on to today's recommendations and great thanks to those who helped draft them. There is a novelty, and as I rarely forget things, I can remember when an observation was made. The Chairmen deplored that the text is in French and that the translation is oral or sometimes only a couple of recommendations are translated into English. But this time all recommendations are in both languages and on top of that the translator who is also one of the interpreters had a good idea. Instead of two documents the text is on two columns making it is easier to control and follow. These recommendations will now be distributed: in the meantime Mr. Co-chairmen, I will talk about the date of the next plenary session.

## V.2 Date of the Next Plenary Session, by Mr Azedine Beschaouch

The secretariat asked a few *ad hoc* experts and other heads of delegation about our next ICC. Usually the session is held at the end of November or early in December. The second week of December is the date proposed, before Christmas, around Monday the 7<sup>th</sup> or Tuesday the 8<sup>th</sup> in order for the experts to arrive on Thursday evening and work on the Friday, Saturday and Sunday. Obviously, this exact date needs to be confirmed by their Excellencies the French and Japanese Ambassadors with the experts coming on December 4, 5, 6. As usual, this is only provisional if both Co-Chairmen and H. E. the Deputy Prime Minister tell us that they cannot attend on those dates. If so, they will be changed. The date will either be on December 7 or 8 as the plenary lasts only one day. We also know that usually HE the Deputy Prime Minister wishes not to convene on Mondays, that's why we give two dates Monday 7 and Tuesday 8. So the decision makers, both Co-chairmen and the Deputy prime Minister, will inform us if they agree. So if no one objects, the dates are the 7<sup>th</sup> or 8<sup>th</sup>, and the experts will arrive on the 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup>. If there are any changes you will be informed before the end of July. So you will have four months from July to December. The conference cannot be held in November due to the UNESCO general elections. Have you all been given the recommendations? After approval from the Co-chairman we will read them out."

### RECOMMENDATIONS OF THE 18<sup>th</sup> ICC TECHNICAL COMMITTEE MEETING

#### CONSERVATION

##### A. GENERAL RECOMMENDATION

###### Recommendation 1:

Storehouses outside of the Angkor Conservancy contain fragments of sculptures, many of which originate from the temples. It is strongly recommended that we entrust junior Cambodian technicians with the job of making an initial inventory that may assist teams working on site to recognize fragments or complete figures. These could be put back into the architectural structure from which they supposedly originated, such as the Angkor Wat cruciform terrace. [*Precision of M. Beschaouch: 'during Mr. Santoro's report, the observation was mentioned and the experts have answered'*]. This recommendation to complete an inventory also applies to stone stored in outlying courtyards of various temples, such as the Bayon or Angkor Wat.

*Comment from Mr. Beschaouch:* "visitors at the Bayon and Angkor Wat see piles of stones. These stones were put there by the conservators—bless those who are not among us anymore. They had the idea of keeping these stones, so they need to be inventoried to distinguish the stones of the temple which will be re-used, and the carved stone. It is a long process. The Japanese team cannot be asked to do it, because it is huge. We cannot tell any teams working on Angkor to do it as it is an immense task. But it would be good training for young Cambodians to carry out this inventory, under supervision and taking the necessary precautionary measures."

*Comment from Mr. Pottier:* "in order to refine this recommendation—although this is not up to me to do this as representative of the EFEO—I would like to mention that there is an existing inventory outside of the storehouses, even if I cannot guarantee its exhaustiveness and documentation. There are inventories kept in the Angkor Conservancy. Here I speak under the authority of the representatives of the Ministry of Culture. It could be interesting to extend these recommendations to the items which are kept inside the storehouses, as there are also several architectural fragments, notably in storehouse C."

*Question from Mr. Beschaouch:* "thank you. So you are certain that there is an inventory at the Angkor Conservancy?"

Answer from Mr. Pottier: “absolutely, two even; the first regarding items kept at the Angkor Conservancy before the war, handwritten and kept as index cards which the EFEO scanned and handed out on a DVD a couple of years ago if I am not mistaken”.

Comment from Mr. Beschaouch: “in that case, these inventories are irrelevant and dated so maybe we could add and let me ask the experts: ‘this work can be an update of existing inventories’ in order not to have any preconceptions”.

Additional comment from Mr. Pottier: “as I personally worked in the Angkor Conservancy and its storehouses for many years, I recommend to train these young Cambodians because there is nothing more similar than a naga from Angkor Wat to another naga from Angkor Wat.”

Comment from Mr. Beschaouch: “obviously those young Cambodians will not carry out an inventory without prior training, as to carry out an inventory is one of the most difficult things to do and without guidelines and experts it is impossible. This recommendation is purely on the principle that for the implementation all relevant precautions will be followed. Mr. Chairman before the intervention of the representative of India let me make sure that my colleagues will take what I added into account. Do you agree on the additional comment made by the representative of the EFEO?”

Comment from Mr. Royère: “if I understand correctly, the recommendation deals purely with architectural fragments but there is in the Angkor Conservancy a multitude of statues. It shall be detailed that we only deal with architectural, masonry or bas-relief fragments.”

Comment from Mr. Lablaude: “on the other hand we are not going to put back all the statues, so if we take into consideration that these nagas are architectural fragments.”

Comment from Mr. Beschaouch: “I repeat in French but I think it is the same in English: ‘these could be put back into the architectural structure’. If we state this, we are not going to put back a statue in an architectural structure. I understand what you mean but let’s not open up to all perspectives. So for the end of the recommendation we add that there are existing inventories.”

Comment from an unidentified member of the Indian delegation: <sup>[OrigE]</sup> “I suppose one would want a clarification not on the inventory but on the part in English which says: ‘These could be put back into the architectural structure from which they supposedly originated’. This should be done only if we are sure that this particular piece or sculpture belonged to that portion otherwise there could a question mark on the authenticity of that.”

Question from Mr. Beschaouch: <sup>[OrigE]</sup> “thank you as in English you are not certain as in French we use ‘comme on le suppose’, and if you think that in English ‘supposedly’ can be disturbing we can change it. Would you come up with something in English?”

Answer from the same unidentified member of the Indian delegation: <sup>[OrigE]</sup> “Actually I would have to rephrase it so this would take some time. I come back to you later on that.”

## **Recommendation 2:**

Analysis work being done in preparation for structural consolidation has brought to light the advanced decay being suffered by many stone blocks on various structures. It is therefore imperative, for the conservation of materials in keeping with current standards, to bring in, whenever necessary, the specific skills of a stone restoration specialist competent in the fields of structural engineering common to basically all teams working at Angkor.

The same is true wherever interventions involve the discovery of earth-covered structures or archeological study, identification of decorative sculptured components that have been buried for several centuries and of which the material or the decorative carvings on it run the risk of rapid deterioration.

*Comment from Mr. Beschaouch:* "we did not mention any example but elements of a naga were discovered in Beng Mealea; they were put back and they decayed within two or three months, as it was buried for hundred of years and was suddenly uncovered and decay set in. That is the reason why we use the phrase: '*phénomène d'altérations*'; so that precautions are taken. The English will actually be changed."

### **Recommendation 3:**

Ongoing debate is a current feature of Angkor, as well as elsewhere on sites inscribed on the World Heritage List.

Such debate—on issues of ethics, aesthetics and technology—confronts different approaches, thus highlighting their respective pros and cons:

- ⇒ on the one hand involving the practice of dismantling and reassembly,
- ⇒ on the other hand the *in situ* consolidation of defective structures.

In this regard, the *ad hoc* experts would like to recommend a middle line: limit dismantling and reassembly operations to cases where the extent of the damage is such that the monument cannot be consolidated in its current state.

*Comment from Mr. Beschaouch:* "here we take a stance between two main trends and the experts advocated a mitigating attitude, a study on a case by case basis as rightly said by Professor Lablaude".

### **Recommendation 4:**

Conservation of the Angkor heritage must be holistic and not overlook brick structures.

It is therefore particularly recommended that the APSARA National Authority, in its capacity as project owner, as well as the international teams, devote part of their budget, study effort and technical staff to implementing:

- ⇒ first, immediate protective measures, such as propping, to ensure stability,
- ⇒ followed by programmes with a focus on consolidation.

### **Recommendation 5:**

Many comments were heard tending to highlight the threat that tree cover can have on historical buildings. But it must be remembered, however, the forest cover is a heritage, of which the Ta Prohm temple is an illustrious example.

This is completely in line with the 1972 Convention on the protection of world cultural and *natural* heritage. It is recommended that treatment of the forest cover in Angkor be a matter of routine. Overall management is under the purview of the APSARA National Authority's Forestry, Cultural Landscape and Environmental Management Department.

*Comment from Mr. Beschaouch:* "it sounds obvious but it is an important point so that trees are not cut indiscriminately or all trees are left on site. Here this is management".

## **B. SPECIFIC RECOMMENDATIONS**



The APSARA National Authority is urged to issue as quickly as possible authorisation needed so that actual fieldwork can begin.

*Comment from Mr. Beschaouch:* "some teams mentioned that they encountered delayed, so we discussed this with the APSARA General Director, HE Mr. Bun Narith. This is to make sure that the people who have the money, formal approval and the go ahead from our committee do not wait. This is a recall but we are sure that the APSARA Authority will see to it".

### C. SUSTAINABLE DEVELOPMENT RECOMMENDATIONS

#### Recommendation 1:

It is recommended that the Siem Reap Municipal Offices and the APSARA National Authority pay particular attention to:

- a. The control of pollution in all its forms;
- b. Preservation of the cultural and natural assets of Siem Reap town;
- a. The need to promote Khmer architecture as much as possible when new construction is involved.

*Comment from Mr. Beschaouch:* "this is mirroring the two presentations made today, one by the Japanese team, the other by the *ad hoc* experts on sustainable development and additional remarks made. Also, HE the Deputy Prime Minister stated that he agreed to set up a working group under the aegis of the Governor".

*Comment from Mr. Pottier:* "this is probably reaching the limit of my ability, but I have trouble determining what is Khmer architecture. I wonder if calling it like this could not lead to abuse of interpretation and if a wording like quality or adapting architecture would not be more generic and *in fine* more fitting with the characteristics of the habitat and the general architecture which can be seen in the urban environment of Siem Reap. As we all know it is made up of several layers, some vernacular, others with shophouses, wrongly called colonial architecture and which are not really Khmer, so a more generic wording shall be drafted".

*Answer from Mr. Beschaouch:* "here we deal exclusively with modern constructions not with old ones. May be we could word it as: 'integrated architecture'? But integrated architecture for new constructions is actually at cross-purpose. Maybe it should be: 'to promote integrated architecture as much as possible when new construction is involved'. Therefore: 'the need to promote integrated architecture as much as possible when new construction is involved'."

*Comment from an unidentified individual:* "I would like to react to point a: I tried to find a place to store dangerous materials such as empty bottles of epoxy. I cannot get any answer from anyone and this is for me a very important issue. I can quote HE Sok An who said that waste shall be prevented and water protected. So where can we store empty bottles with chemical contents, which all the teams are using. Is there a storage location in Siem Reap?"

*Answer from Mr. Beschaouch:* "dear colleague we understand your request and you draw attention on a specific case but this is more a practical point. Are you against the wording 'pollution in all its forms'? You do not want this wording to be used? That's what we would like to know."

Answer from the unidentified individual: "this is here a practical case, I agree with you. I, like all international teams, use dangerous materials and I have asked everyone where I could store these empty bottles holding dangerous contents and no one has any idea".

Answer from Mr. Beschaouch: "thank you very much because you give us here an example on how this recommendation could be implemented, we note it down as, rightly, there is the need to know how to dispose of these materials. I have just been told that HE the Deputy Prime Minister, President of the APSARA, must leave for the airport at 7pm and the plane won't wait and, he, in contrast to Mr. Beschaouch, is never late. So I suggest that we pass on to the final recommendation and to later go back to the one we just talked about. The final recommendation is on illumination at Angkor Wat, pages 5, 6 and 7."

#### **d. Special recommendations on testing illumination at Angkor Wat**

Introduction from Mr. Beschaouch: "two years ago we had to assess an illumination proposal which was at the time rejected during its presentation in meetings and on site. Since then, several experts have been to the site, in particular one from Versailles who is used to monuments from the World Heritage. We here thank HE Mr. Sok An, who made sure that the expertise shall be monitored and see to the safeguarding of the World Heritage. So an expert has come to draft a plan, not an illumination project, and you have all been informed. The public was also misled, and I can say that because someone wrote, to the whole, world misleading and false assertions: that holes were bored inside the gallery and that non- standard materials were mounted. Someone even said that a World Heritage Site cannot be illuminated. Then we have to react, we can decide not to illuminate as was proposed. But to say 'the World Heritage Monuments are not illuminated', I can start with Paris and end up in China to establish a long list: is Angkor Wat not on the same par as the Colosseum in Rome, the pyramids in Egypt, on all the monuments of Paris inscribed on the World Heritage List, on Carthage and so on, the Taj Mahal, the Red Fort...I mention this because we also work for culture and we must fight against disinformation. So the experts went on site and the informative work against disinformation has been carried out. Here is the recommendation read rapidly."

In step with the practice of illuminating other prestigious monuments and sites elsewhere in the world and holding "sound and light" events in them, the illumination of Angkor Wat is anticipated to be another means of enjoying this most exceptional site.

However, experts strongly recommend that any operation of this type on a site that is so fragile must be carried out by specialists who will work in close cooperation with the conservators in charge of its protection and in keeping with the specific guidance of the *ad hoc* experts.

The spirit of such an undertaking should be to highlight at night what cannot be seen during the day. What is involved here is highlighting the impressive architectural masses, the surrounding vegetation and bodies of water.

**ACCORDINGLY, THERE DOES NOT APPEAR TO BE ANY POINT IN LIGHTING UP DETAILS OF BAS-RELIEFS**, for instance, that can be enjoyed during daytime visits.

Issues of personal safety must also be a priority consideration, which means that both illumination inside the temple and allowing people to go through the galleries **ARE STRONGLY ADVISED AGAINST**.

The *ad hoc* group of experts therefore proposes that visitor access at night be limited to one **OUTSIDE** thoroughfare from the causeway-dyke leading to the end of the cruciform terrace, and to completely rule out any extension beyond that. This is our initial conclusion.

With regard to putting in grids, wireworks and lighting accessories, the experts feel that cannot but have a **NEGATIVE** physical and aesthetic **IMPACT**, during the daytime in particular, on various parts of the monument. They therefore make the following recommendations:

- 1- Design any set-up so that it is completely reversible, with no encroachment on the integrity of the monument.
- 2- Submit in advance to an APSARA-*ad hoc* expert technical committee the site illumination design package that takes the above guidelines into account;
- 3- Ensure that the lighting material now in place on a temporary basis is removed in anticipation of the submission of the said detailed design package for the installation of wiring and spotlights.

Above all, **THE TEMPLE MUST BE PRESERVED**. Opening it at night may only be authorized (except for reasons of national importance) on the basis of a set of specifications that complies with norms applicable to a world heritage monument.

### Overall recommendation

On the basis of all the foregoing remarks, words of advice, warnings and special recommendations, the *ad hoc* group of experts recommends that:

- a- Mr. Bennys, a lighting expert, be commissioned to continue preparing the Angkor Wat illumination design package;
- b- a specific zone for illumination be delimited between the entrance causeway-dike on the west up to the end of the cruciform terrace;
- c- this program is to be set up, in close cooperation with the General Directorate of the APSARA National Authority and in liaison with the ICC Secretariat for Angkor.

Comment from Mr. Beschaouch: "on this point all precautions have been taken, and the World Heritage Committee will convene on the 22<sup>nd</sup> of this month. Mr Bouchenaki as former general Director of UNESCO, after 24 years at UNESCO and now General Director of ICCROM, will assist to the meeting to present this subject. As for myself, as an expert on Heritage and with 50 years experience, I will bring my testimony and I challenge anyone within the Heritage world to say anything but the truth. So rest assured that with this recommendation we will help the Royal Government avoid bowing to pressure which asks for more than is necessary to be done on the monument. Because there are also lobbies to illuminate the whole monument and others advocating nonsense, so with these recommendations and if you agree, we trust that the Royal Government will continue to manage the temple day and night respecting the guidelines of the World Heritage."

Comment from Mr. Jacques: "I believe that we have to preserve the value of the sacred feature of the monument of Angkor Wat. I recall here that Cambodia is I believe the only country in the world which has a monument on the flag. This has a meaning and is a vital observation. I agree with illuminating, from outside, the monument: this seems normal. But illuminations inside the monuments and the small additions that could go with it would most certainly miss what gives Angkor Wat its integrity and shall be forbidden."

Comment from Mr. Beschaouch: "thank you Professor for this observation. Illumination shall start with the entrance moats, the architectural structure of the first enclosure up to the cruciform terrace. The surrounding vegetation is magnificent and the illumination enhances the towers. I would like to quote, and thank him for it, the recommendation made by Mr. Ros Borath the other day: 'please do not affix anything on the towers as they are fragile'. Nothing will be affixed on them and recommendation is made to light the towers from the rear and that the illumination structure shall be reversible and invisible. So you can see that precautions are taken and thank you for having recalled the sacred feature of the temple."

Comment from an unidentified individual: <sup>[OrigE]</sup> "I have three points to make: firstly: we suggested the word 'definitively' instead of 'supposedly' to eliminate any doubt. Regarding recommendation 3, 'sometimes involving the practice of dismantling and reassembly and other times the *in situ* consolidation of defective structures'..."

Comment from M. Beschaouch: <sup>[OrigE]</sup> "excuse me dear colleague but we have to allow tie for His Excellency the Prime Minister to go to the airport. If you have a comment on this matter, we will adopt first then you can make your point."

Answer from the unidentified individual: <sup>[OrigE]</sup> "Ok. I do it later."

Comment from Mr. Beschaouch: "can we now consider that at our level and as was presented with the relevant precautions, that this recommendation is supported and adopted? We all agree. I now turn to the Co-Chairmen. With this approval would you allow us to inscribe this recommendation with other recommendations which will be submitted to the plenary committee as per our procedure?"

Comment from the Co-chairman for Japan: "with a rider, as the experts' recommendation on the Angkorica project is not on there and this is a technical itch".

Comment from Mr. Beschaouch: "I agree, so now we turn to HE Sok An. Is someone going to give on your behalf the concluding speech? Or can you wait another 15 minutes?"

Answer from Mr. Sok An: "I think there is sufficient time".

Comment from Mr. Beschaouch: I then come back to recommendation 2 on page 4 as we read out the first one but not the second".

## E. DEVELOPMENT RECOMMENDATIONS

### Recommendation 2:

The *ad hoc* experts observed that the wooden staircase (nice looking and undoubtedly costly), which was put up to enable safe visitor access to the Bakan (upper parts of Angkor Wat temple), has not yet been put to use.

The experts recommend that visitor access using this staircase be given the green light as quickly as possible.

Comment from Mr. Beschaouch: "as they have assessed, structurally there was no safety problem. ASPARA as is mentioned in the experts' report has built a 'staircase (nice looking and undoubtedly costly)'; therefore this part of the temple shall be re-opened as many visitors complain that they cannot take pictures of the upper part. Now I turn back to our colleague".

Comment from the unidentified person: <sup>[OrigE]</sup> "I was on recommendation number 3. This can be discussed but what we were saying is that this temple can be preserved and that maybe we could swap point 1 with point 2 and vice versa. First of all let's try to do an *in situ* consolidation and if that is not possible then we have to move to dismantling and reassembly. It is just thinking in terms of interchanging two points and making them sequential. That was my observation regarding recommendation 3."

Remark from Mr. Beschaouch: "what do you think of this? No problem, so we swap both recommendations. Could you repeat for our secretariat and some of our colleagues?"

Comment from the unidentified person: <sup>[OrigE]</sup> "what I am trying to say is that in recommendation 3: 'such debate—on issues of ethics, aesthetics and technology—confronts different approaches, thus highlighting their respective pros and cons:

- Sometimes involving the practice of dismantling and reassembly,
- At other times the *in situ* consolidation of defective structures.'

So what I am trying to say is that 'the *in situ* consolidation' should be tried first and if we are not able to achieve then we should go to 'dismantling and reassembly'."

Comment from Mr. Beschaouch: "in French:

- *d'une part, la pratique de la consolidation en place de structures déformées*
- *de l'autre, celle du démontage-remontage'*

This is the new version in French.

[*OrigE*] In English:

- on the one hand the *in situ* consolidation of defective structures,
- on the other hand involving the practice of dismantling and reassembly."

Comment from the undidentified person: [*OrigE*] "the second point was recommendation 1 regarding the area of developments: 'c. The need to promote Khmer architecture'. Our experience from India is that once we have specified something like this, it can have, sometimes, social and cultural implications. Vernacular would be a more appropriate word here but what I am trying to say is that this is an exercise which is a bit more complicated arising from the urban study of Siem Reap in this case where we identify the buildings of historical and cultural value. We identify precincts. So there should be guidelines which should be different in case of this historical precinct. There are different guidelines in case of the new development that are coming up and there are different guidelines in case of the development around or within the world heritage site. Where we do the core and buffer zones. So this should be indicated here rather than being simplistic because it could have implications. Thank you very much."

Comment from Mr. Beschaouch: [*OrigE*] "I don't know what we put in English, because in French it is not Khmer architecture but something like integrated, but am not sure."

[Mr. Beschaouch reverts to French]: I don't know what Khmer architecture is but as for non-Khmer architecture I've had enough of it. This should not turn into a scholarly discussion otherwise *laissez faire* will reign in this town; this has already started and has gone very far. [*OrigE*] We will try to find something which matches but thank you for your contribution as it is very important."

**18<sup>th</sup> ICC Technical Session**  
**June 2 & 3, 2009**  
**GENERAL RECOMMENDATIONS**

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This recommendation **about** inventory also applies to stone stored in outlying courtyards of various temples, such as the Bayon or Angkor Wat.

**Recommendation 2 :**

Analysis work being done in preparation for structural consolidation has brought to light the advanced decay being suffered by many stone blocks on various structures. It is therefore imperative, for the conservation of materials in keeping with current standards, to bring in, whenever necessary, the specific skills of a stone restoration specialist competent in the fields of structural engineering common to basically all teams working at Angkor.

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Ongoing debate is a current feature at the Angkor, as well as elsewhere on sites inscribed on the World Heritage List.

Such debate—on issues of ethics, esthetics and technology—confronts different approaches, thus highlighting their respective pros and cons:

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In this regard, the *ad hoc* experts would like to recommend a middle line: limit dismantling and reassembly operations to cases where the extent of the damage is such that the monument cannot be consolidated in its current state.

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It is recommended that treatment of the forest cover in Angkor be a matter of routine. Overall management is under the purview of the APSARA National Authority's Forestry, Cultural Landscape and Environmental Management Department.

### **SPECIFIC RECOMMENDATIONS**

The APSARA National Authority is urged to issue as quickly as possible authorization needed so that actual field work can begin.

### **RECOMMENDATIONS IN THE AREA OF DEVELOPMENT**

#### **Recommendation 1:**

It is recommended that the Siem Reap Municipal Offices and the APSARA National Authority pay particular attention to:

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- d. Preservation of the cultural and natural assets of Siem Reap town;
- e. The need to resort as much as possible for new construction to an integrated construction.

#### **Recommendation 2:**

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tion of Angkor Wat is anticipated to be another means of enjoying this most exceptional site.

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**ACCORDINGLY, THERE DOES NOT APPEAR TO BE ANY POINT IN LIGHTING UP DETAILS OF BAS-RELIEFS**, for instance, that can be enjoyed during daytime visits.

Issues of personal safety must also be a priority consideration, which means that illumination inside the temple and allowing people to go through the galleries **ARE STRONGLY ADVISED AGAINST**.

The *ad hoc* group of experts therefore proposes that visitor access at night be limited to one **OUTSIDE** thoroughfare from the causeway-dike leading to the end of the cruciform terrace, and to completely rule out any extension beyond that. This is our initial conclusion.

With regard to putting in grids, wireworks and lighting accessories, the experts feel that cannot but have a **NEGATIVE** physical and esthetic **IMPACT**, during the daytime in particular, on various parts of the monument. They therefore make the following recommendations:

- 4- Design any set-up so that it is completely reversible, with no encroachment on the integrity of the monument.
- 5- Submit in advance to an APSARA-*ad hoc* expert technical committee the site illumination design package that takes the above guidelines into account;
- 6- Ensure that the lighting material now in place on a temporary basis is removed in anticipation of the submission of the said detailed design package for the installation of wiring and spotlights.

Above all, **THE TEMPLE MUST BE PRESERVED**. Opening it at night may only be authorized (except for a reason of national importance) on the basis of a set of specifications that complies with norms applicable to a world heritage monument.

### **OVERALL RECOMMENDATION**

On the basis of all the foregoing remarks, words of advice, warnings and special recommendations, the *ad hoc* group of experts recommends that:



- d- Mr Bennys, a lighting expert, be commissioned to continue preparing the Angkor Wat illumination design package;
- e-A specific zone for illumination be delimited between the entrance causeway-dike on the west up to the end of the cruciform terrace;
- f-Set up this program, in close cooperation with the General Directorate of the APSARA National Authority and in liaison with the ICC Secretariat for Angkor.

**Report of the Ad hoc Expert group  
for sustainable development on the ANKGORICA project**

Following their considerations of the ethics and processes of sustainable development, the *ad hoc* experts **have warned against the risks created by the over-exploitation of a World Heritage site.**

The Angkor site is both a sacred space and a very meaningful cultural place. **A legitimate tourism exploitation of the site should not turn it into a simple background for entertainments nor into a marketing tool.**

These principles are again raised, principles which on the national level are within the framework of the Royal Decree provisions dated May 28, 1994 and on the international level within the framework of standards applying to sites and monuments inscribed on the World Heritage List.

Such being the case, the *ad hoc* experts specifically recommended:

**A**

A refusal to grant any authorisation for the overall organisation of any entertainment which could impact at the same time a large number of prestigious monuments:

1. Bayon
2. Angkor Wat
3. Bantey Kdei
4. Neak Pean
5. Sras Srang

**B**

In the case of the cultural side being favoured as opposed to a purely marketing approach, and if guarantees to preserve heritage structures were to be obtained, then one could envisage the **granting of authorisation for a theatre play on a large scale.**

But this authorisation shall comply with the following conditions:

1. No structures (stage, amphitheatre, screen, speakers) even of light construction shall be directly mounted on the walls and shall not be rested on the stonework of the temple.
2. The amount of spectators shall depend on the security needs of the people and of the location and the preservation of the heritage integrity.

(NB: The ANKGORICA project forecasts 3 000 (three thousand) seats at the Bayon which is unacceptable and dangerous for the monument!)

### V.3 Approval of the Recommendations by the ICC

*Recap by Mr Azedine Beschaouch:* "are there any other comments? If you do not have any we will then, as a consensus has been reached, present these recommendations in English and French. The Secretariat will finalise them and they will be submitted to our Chairmen who will then adopt them at their level. I think we have said enough, and I would like to thank in particular our experts who drafted these recommendations on sensitive issues such as Angkorica, which will be added, or on the illumination. Again, thank you to the translator who helped out and to the secretariat which since this 11am morning has constantly been receiving new elements from me, which have been constantly changing. So now that we made it, thank you and it is now time for you to conclude, thank you very much".

*Comment from the Co-chairman for Japan:* "thank you Mr. Beschaouch. Now that the recommendations have been adopted for this session, I would like to ask my colleague Mr. Dominique Freslon to give his concluding speech".

## VI. CLOSING SESSION

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### VI.1 Speech by the French Co-chairman, Mr Dominique Freslon, Counselor for Cooperation and Cultural Affairs with the Embassy of France

"Honourable Deputy Prime Minister,

Planes do not wait and if I had to make a brief summary regarding restoration and research, I would say that there is continuity for the great restoration sites. New sites have been started and are developing, such as Koh Ker or the Phnom Kulen. Also the central role played by archaeology which has been confirmed by all of us here, who consider it as being at the heart of our work. Prehistory is also on the agenda and is timely, with an exhibition organised in Phnom Penh. There is a growing diversity of the teams' nationalities, with some coming from Central Europe, and also an expert from Brazil who was attending today. Transfer of skills has accelerated. More and more APSARA experts have taken centre stage legitimately and skilfully, which is an extremely encouraging pattern.

The wording sustainable development is slowly finding its ground. But the lack of balance which I mentioned in my opening speech has been widely compensated for by the quality of the interventions, also a positive sign. Training took also centre stage of our discussions. It is developing and is coherently integrating with the rest of the reflection and activity carried out.

This is all I had to say for a synthesis of our works, I would like to thank you all. I would like to thank His Excellency, who as Deputy prime Minister always attends these meetings which is a strong, encouraging sign and shows the value you give to our proceedings. I would also like to thank the Governor of Siem Reap, the secretariat and the interpreters who managed to bridge all these dialogues. I wish all the best for the future to my neighbour on my left, Mr. Morio Maruyama, who is leaving us and I thank you all, see you soon."

### VI.2 Speech by the Japanese Co-chairman, Mr Norio Maruyama, Minister with the Embassy of Japan

"I would also like to thank all participants and in particular HE the Deputy Prime Minister, the Minister and the Governor. It is the last time that I chaired this technical session.

For the past three years, it has been a rare opportunity to work with you. This helped me understand how such an international coordination is operating efficiently. It is not a simple matter. There are coordinations within the coordination. The coordination of experts, then of the international teams, as all teams have their specific training and they mirror a certain idea of the cultures they represent. So I would qualify it as a highly interesting and difficult coordination between cultures.

It is not only a coordination of the culture but also a coordination between development and science. When talking of development, local and national organisation is the focal point. The bilateral aspect of cooperation also plays a role. So within our session we deal simultaneously with a bilateral and multi lateral coordination. New frontiers open up when restoration progresses. This is what I found out today: archaeology is now considered as a very important frontier for restoration work. Professor Claude Jacques referred to archaeology as you did Mr. Bouchenaki, last year. I think that it will take more of a leading role when restoration progresses. And this is noticeable as it is the whole of Cambodia which through the restoration and excavation works is starting to emerge from a different image that we experience presently. We advance towards the search for the truth while going back through history and this is an outstanding accomplishment. I thank you all for your contribution to our works and I wish you to continue this good work which is at the level of a national coordination. Thank you very much."

**VI. 3 Speech by the Representative of the Royal Government of Cambodia,  
HE Mr SOK An, Deputy Prime Minister, Chairman of the APSARA National  
Authority**

"Honourable Co-Chairmen,  
Excellencies  
Ladies and Gentlemen,

Our first expressions of thanks are for both Co-chairmen. Their art of the dialogue, experience and firm grip enabled us to not disregard any of the questions which were on the agenda of the 18<sup>th</sup> technical session of the ICC.

Our thanks are also for the *ad hoc* experts, as always they stand out thanks to their professionalism and consciousness. We shall congratulate them for having established relationships based on esteem and trust with all national and international teams working on the World Heritage site. Mr Teruo Jinnai, the representative for UNESCO in Cambodia confirmed to me that this international scheme of high-level expertise is unique to Angkor. We are commending this.

To this matter I would like to ask Mr. Norio Maruyama, Co-chairman of the ICC, to convey to his compatriot Professor Horiuki Suzuki my feelings of esteem and consideration. We all deplore that his retirement has forced him to renounce his status as *ad hoc* expert. We wish him all the best.

Excellencies, Ladies and Gentlemen,

The ICC followed my recommendations and adequately examined the main questions raised at the onset of these proceedings. I will give instructions to the Office of the General Director of the APSARA National Authority, so that each department will see to benefit from the advice and observations that you have made and the specific recommendation that you have adopted.

Mr. Sou Phirin, the Governor of Siem Reap, who soon will take an additional role as Deputy President of the board of directors of the APSARA National Authority, will with the help of my Deputy HE Mr. Ngo Hongly and with the General Director HE Mr. Bun Narith and his department colleagues, take measures for preservation, safeguarding and, as much as possible, sustainable development. This affects mainly the vegetal canopy of the Angkor

site, the cultural and natural heritage of Siem Reap town and the ecological and heritage potential of Phnom Kulen.

Excellencies, Dear Colleagues,

I notice that all participants have constantly supported the pace of our two-day session. Despite the multitude of questions, you have all carefully listened to the papers and discussions. This is testimony to the good health of our ICC for Angkor. And this is a pledge for the future.

Thank you for your attention.”

#### **VI.4 Speech by the Representative of UNESCO, Mr Teruo Jinnai, Representative of UNESCO in Cambodia**

“Honourable Co-Chairmen,  
Excellency high representative of His Majesty the King,  
Excellency Mr. Deputy Prime Minister,  
Excellencies, Ladies and Gentlemen, dear colleagues,

I will be brief as we conclude two days of the usual intense, broad and detailed discussions. I am sure that the numerous participants in this 18<sup>th</sup> technical session of the ICC for Angkor will have the feeling of leaving with a gigantic pile of information. The unique expertise of the speakers presenting at the ICC was reflected in the outstanding quality of their papers but also in the wealth and scope of the debate.

I will not dwell on the conservation and restoration works as I think that their scientific and practical knowledge is evidence of our success in these fields and work progress; the scientific debate is lively and recommendations are usually followed up.

Nevertheless, I would like to pay tribute to one of our distinguished members, Professor Hiroyuki Suzuki, who has decided to retire. For the past few years we have profited from his expertise and wisdom while appreciating the great simplicity of this scholar.

Conversely, the sustainable development topic raises other complex, multiformed, and often sensitive challenges. This major topic has been on our agenda since the 2003 Paris Conference. New experts have been added to our *ad hoc* expert team. We still have to develop and to age a mechanism which will enable them to apprehend and assess with efficiency the so called ‘development’ projects, of course subject to our ICC for Angkor guidelines, which I would like the Royal Government to engage in.

And how could we not pay tribute on behalf of the UNESCO office to our Co-chairman Mr. Norio Maruyama, who has presided over his last ICC. Mr. Maruyama for the past three years has dedicated his initiative, dynamism and intellectual rigor to the service of Angkor. I personally thank him and wish him, probably on behalf of all of us, a promising and serene future. I also express my thanks and congratulations to our French Co-chairman who has made a perfect tandem with Mr. Maruyama and who is staying with us.

I would finally express through his High Representative my deferential thanks to His Majesty the King Norodom Sihamoni. His sympathetic interest and standing encouragements are overwhelming and always motivate us to continue our mission to serve Angkor, taking as an example the personnel commitment and abnegation His Majesty has been showing since the time when he represented the Kingdom of Cambodia at UNESCO.

Our ICC has become an example for cooperation between a host government and the international community, both willing to ensure the preservation and development of a site of World Heritage. It is also a model for scientific and technical exchanges and of shared knowledge.

I also thank all participants and colleagues, the members of the secretariat and our admirable interpreters who facilitate so much our proceedings.

Have a safe trip for those returning to far away destinations and we shall meet at the next ICC session; I hope it will take place in December.

Thank you very much.”

**\*\* Conclusion of the 18<sup>th</sup> ICC Technical Committee Meeting \*\***

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