



Phnom Bakheng Workshop on Public Interpretation

Angkor Park
Siem Reap, Cambodia

December 4-6, 2005



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APSARA

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Conference Proceedings

Phnom Bakheng Workshop on Public Interpretation

**Angkor Park
Siem Reap, Cambodia**

December 4-6, 2005

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Photo: Michael Ellis, 2005

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The contents of this book and additional Phnom Bakheng Workshop on Public Interpretation articles are available in PDF form on the Center for Khmer Studies Web site, www.khmerstudies.org

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ព្រះរាជាណាចក្រកម្ពុជា
ROYAUME DU CAMBODGE

ជាតិ សាសនា ព្រះមហាក្សត្រ
NATION RELIGION ROI



Siem Reap, June 2, 2006

Dear Friends and colleagues,

On behalf of the APSARA Authority, it is my pleasure to associate in the launching of the publication of the Phnom Bakheng Workshop on Public Interpretation proceedings. The book is a groundbreaking collection of history, new research, and site planning for the Phnom Bakheng monument in historic Angkor Park, published by the Center for Khmer Studies for the World Monuments Fund. The book is the first in their new series of conference proceedings and features papers presented at the Phnom Bakheng Workshop on Public Interpretation, held at the Center for Khmer Studies, Siem Reap, Cambodia, December 4-6, 2005. The conference was supported in part by an award from the U.S. Department of State for the Phnom Bakheng Conservation and Presentation Project.

The APSARA Authority is proud to have the World Monuments Fund as a partner in finding the best solution for the visitor to enjoy their best and meaningful experience at Phnom Bakheng that addresses not only the preservation of the site and its socio-cultural significance, but also takes into account the needs and interests of the local communities. The project aims to reflect the interests, traditions, and outlook of the Cambodian people, whose heritage this site represents. The publication of the Phnom Bakheng Workshop on Public Interpretation proceedings demonstrates our commitment to an interdisciplinary and scholarly approach to monument planning. It is my hope that this approach can serve as a model for other sites at Angkor.

Sincerely yours,

BUN Narith
Director General
APSARA Authority

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Foreword

In 2004, APSARA, the Authority for the Protection and Management of Angkor and the Region of Siem Reap, and the World Monuments Fund came together in a collaborative effort to safeguard one of the most threatened sites at Angkor Park, the temple-mountain of Phnom Bakheng. This tenth-century site, Angkor's earliest capital, was in grave danger from the pressures of increased tourism, a phenomenon that is changing the experience and maintenance of all sites under APSARA's aegis. Although little understood by visitors, Phnom Bakheng is a popular site for its sunset views, attracting thousands to its summit each day.

At the invitation of the APSARA Authority, the WMF has proposed the development of a conservation and presentation plan for Phnom Bakheng as part of a larger structural stabilization and conservation program. Now entering its second year, the Phnom Bakheng Conservation and Presentation Project has already experienced many significant firsts.

In November 2004, the U.S. State Department awarded a grant for the launch of Phase 1, which includes project identification, survey, analysis, conservation planning, and designs for the interpretation of the complex. This grant of \$550,000 represents the first time the U.S. government has directly supported conservation work at Angkor.

Four key international technical missions to the site have thus far defined the physical and conceptual parameters of the project, identified a team of international and Khmer professionals to carry out the work, produced a risk map of site conditions, launched a series of key research projects, carried out emergency stabilization at twelve locations, and produced a draft Master Plan for the Conservation and Interpretation of Phnom Bakheng. The first twelve months of collaborative work have succeeded in forging an enhanced working relationship between the APSARA Authority and the WMF.

In another first, the project provides an opportunity for a new level of cooperation between our two organizations. The WMF began work at Angkor in 1989, collaborating closely with the APSARA Authority's Department of Monuments and Archaeology 1 on conservation projects at Preah Khan, Angkor Wat, and Ta Som. The multi-disciplinary components of the Phnom Bakheng project have made it possible for the first time to carry out a project that brings together APSARA specialists

from all departments in a comprehensive approach to conserving and presenting this site. The APSARA Authority was significantly involved in the Phnom Bakheng Workshop on Public Interpretation, with strong participation of Khun-Khuon Neay, Director of the APSARA Department of Monuments and Archaeology 2, Chau Sun Kérya, Director of the Department of Tourism, and Hang Peou, Director of the Department of Water and Forestry.

Complementing this expertise, members of the WMF's Phnom Bakheng project team come from diverse organizations and backgrounds, ranging from representatives of the U.S. National Park Service to the Khmer architects and archaeologists who have worked with WMF in the past. Another significant project partner is the Association des Amis d'Angkor (AAA), which is providing technical conservation research as well as the history and historiography of the site. The AAA also helped organize a November conservation meeting in Paris attended by the WMF and technical experts from the AAA.

In addition to these scholars and specialists, the project team includes planners from Jane Clark Chermayeff & Associates (JCC&A), who have been asked to develop a plan for interpretive programs at Phnom Bakheng. Their involvement marks the first time at Angkor that interpretive planning is being integrated into conservation and site planning. An effective site interpretation scheme will present a more lucid and complete explanation of the history and significance of Phnom Bakheng than currently exists at any site in Angkor Park.

As a basis for their efforts, JCC&A has organized the Phnom Bakheng Workshop on Public Interpretation to bring out all aspects of site scholarship including history, archaeology, vegetation, and tourism. The two-and-a-half-day workshop confirmed our experience to date: the collaboration between the APSARA Authority and the WMF holds tremendous potential for success in preserving the physical majesty of Phnom Bakheng and for bringing its historical and cultural significance to light for all visitors.

Bonnie Burnham, President, World Monuments Fund

Acknowledgements

This publication would not have been possible without the contributions and insights of the participants in the Phnom Bakheng Workshop on Public Interpretation. Special appreciation goes to His Excellency Bun Narith, His Excellency Ros Borath, and the APSARA Authority for their involvement in the planning, implementation, and follow-up of this workshop. A gathering of this intellectual scope and international representation could take place only with the tremendous vision and dedication of the World Monuments Fund president, Bonnie Burnham, and vice president for field projects, John Stubbs.

Sincere thanks go to the Wat Damnak, particularly the Venerable Chhun Choeurn for conducting the opening blessing ceremony and for participating in the workshop sessions, and to the U.S. Embassy in Phnom Penh for the generous involvement of Ambassador Joseph Mussomeli, Sharon Mussomeli, and Jeff Daigle. The Center for Khmer Studies provided excellent facilities for the gathering as well as assistance from its expert staff, including Philippe Peycam, Lesley Perlman, Christiane Lalonde, Tith Sreyphich, Chhim Phet, Mam Vannary, and Oum Daraneth. Significant contributions to the substance, organization, and success of the workshop were made by Jane Clark Chermayeff and the staff and interns of Jane Clark Chermayeff & Associates, New York, who planned the workshop and edited this publication, including Julia Rousakis, Jill Gilmartin, David Barber, Coline Irwin, Christina Ferwerda, and Rose Ginsberg; the World Monuments Fund staff in Siem Reap, including John Sanday, Prasanna Weerawardane, Chhan Chamroeun, Cheam Phally, Sam Kimheng, Hem Sinath, and Chhun Soma; the Association des Amis d'Angkor, including François Legrand, Catherine Roussy, Michel Bancon, Jacques Dumarçay, Jean-Jacques Dupuy, Pierre Clement, and Jean-Jacques Rincant; Holly MacCammon, Grants Manager, Angela Schuster, Director of Publications, and Nuha Ansari, Program Assistant, World Monuments Fund; the workshop translators, Lionel Courty and David Rorke; Stefan Yarabek, whose Phnom Bakheng site plans were displayed throughout the workshop conference space; Glenn Boornazian and David Flory, Integrated Conservation Resources, New York; Fred Frumberg, Amitra Performing Arts; the Wat Bo Shadow Puppet Troupe; Roland Fletcher, Greater Angkor Project; and the Living with Heritage team, including Sharon Sullivan, Richard Mackay, and Senthil Kasiannan.

A shared interest in the future of the Phnom Bakheng site has drawn this talented group of people together. This publication is an expression of the hope that the conservation and presentation project will continue with the support and participation of these noteworthy contributors.

Preface

"If the Khmer people do not know the temples, they do not know themselves." These words, spoken by the Venerable Chhun Choeurn of Wat Damnak, stayed with me after the Phnom Bakheng Workshop on Public Interpretation, and I believe the statement can serve as a byline for the Phnom Bakheng Conservation and Presentation Project. Our conservation and presentation actions at Phnom Bakheng have the potential to significantly affect not only the future of this key site at Angkor, but also its Khmer communities.

One conclusion of the Phnom Bakheng Workshop that I have found to be reassuring is that the World Monuments Fund's long held philosophy of engaging local support and involvement in our projects is the main desired approach for the new Phnom Bakheng conservation initiative. WMF's work at Angkor, and at Phnom Bakheng in particular, is informed by the principles that guide the organization's projects worldwide: engage fully with the local community, develop technologically and culturally appropriate conservation solutions; build local capacity through training and education; use conservation approaches that embrace environmental, social, and community factors; encourage economic self-sufficiency; and share information and learning both within the host culture and internationally. At our Angkor projects, more than anywhere else, WMF has stressed on-site training for local graduate and post-graduate level architects and archaeologists to help replace the expertise lost in Cambodia's years of civil conflict.

The present workshop is significant in demonstrating these approaches. The concluding session revealed that we have turned up an amazing amount of new information about Phnom Bakheng, and, as important, we are generally in agreement on its importance and about the roles this information can play in the future display of the site. Scholars and specialists have exchanged insights and opinions on all aspects of the Phnom Bakheng project in a truly holistic and integrated manner. Much of the discussion has helpfully centered around "big picture" issues: reduction of mass tourism at the site, better management of those who do visit the site across more hours of the day, the enhancement of what one learns at the site, the alternatives for access, and the importance of input from both the community and the APSARA Authority through all phases of the planning, implementation, and maintenance process.

The setting of the workshop at the Center for Khmer Studies was duly significant as the WMF founded the center in 1999 to serve as a locus for Cambodian scholars and

students to document and study Khmer culture. Now six years later, the WMF is especially gratified to see that CKS is so effectively fulfilling its mission.

One of the center's chief concerns is improving the state of higher education in Cambodia particularly by addressing the almost total absence of quality published material in Khmer. CKS has begun work to establish a strategic plan for an academic publishing program, which should lead to the translation and publication of dozens of Khmer titles in future years. We are proud that this volume featuring the Phnom Bakheng Workshop on Public Interpretation is the first in its new series of conference proceedings.

John H. Stubbs
Vice President, Field Projects
World Monuments Fund

Introduction

Jane Clark Chermayeff, Jane Clark Chermayeff & Associates

It has been said that “a place is a space with a memory.” Phnom Bakheng has been the source and object of memories for more than a millennium. Conservation will ensure that the *physical memory of its storied past is preserved*. Now, innovative plans to enhance the visitor experience and community participation hold the promise that Phnom Bakheng will remain a memorable place for generations to come.

What makes plans for an interpretive program at Phnom Bakheng novel and ambitious is the decision by the World Monuments Fund (WMF) and the APSARA Authority to pursue a comprehensive approach, integrating site presentation into conservation and site planning. This approach to interpretation requires building a base of knowledge that covers the breadth of historical and contemporary research into Phnom Bakheng. It also brings in the opinions of key stakeholders, including the local population and the tourism industry. Based on these inputs, the plan for site interpretation will provide a foundation for future decision-making and tools for determining priorities to guide long-term conservation of the site.

The Phnom Bakheng Workshop on Public Interpretation was thus a key step in developing a multidisciplinary, comprehensive master plan. The partnership with the APSARA Authority further ensures that the process will reflect the interests, traditions, and outlook of the Cambodian people, whose heritage this site represents. Our hope is that this comprehensive approach can serve as a model for other sites in Angkor.

Interpretive planning

There is power in the experience of place. Interpretation shapes the visitor experience—perhaps most obviously through signs and exhibits, but also through less tangible factors that affect what a visitor sees, feels, and learns at a site. A well-crafted interpretive plan ensures that all aspects of a project have meaning, so that visitors will be physically accommodated and will have the opportunity to be both educated and inspired by their visit.

Our audience represents varied backgrounds, and interpretation must address the needs and expectations of these different groups. To succeed, an interpretive plan also must reflect a close examination of the interests and needs of relevant *contextual communities and anticipated partners*. At the same time, any program of interpretation must remain flexible enough to respond to the evolving needs of site planning and conservation.

In its final form, interpretation is about telling stories. Drawing from the presentations and outcomes of the Phnom Bakheng Workshop on Public Interpretation, we

can provide visitors with the most illustrative stories from which they can form their own, individual experiences of this awe-inspiring site.

The Scholars Workshop

The idea for a Phnom Bakheng Workshop was conceived in early 2005, following the WMF's first mission to begin planning the preservation and restoration of the site. During that study trip, in December 2004, it became clear to many members of the planning team that significant aspects of the site's history and even its physical situation were still being debated. How can we tell the definitive story of Phnom Bakheng if the story was still being written and rewritten? In truth, we cannot. What we can do is ask questions and present the best answers available in all their facets. To shape interpretation for Phnom Bakheng, we worked with the WMF, the APSARA Authority, and the Association des Amis d'Angkor to organize the scholars workshop reflected in these pages. The meeting brought together leading international experts from a range of disciplines, in order to gather the most current research on this key monument over time. To insure that the interpretation of Phnom Bakheng covers complexities and nuances related to all aspects of the site's significance, we invited specialists on its history, ecology, art and architecture, tourism, and site planning. Among the workshop participants were Khmer experts whose ongoing contributions to site preservation engage the local population in the safeguarding of their patrimony.

The workshop began in an apt setting—a group visit to the Phnom Bakheng site during the crowded sunset hour. The first day of scholars sessions opened with a blessing from monks of the Wat Damnak and a presentation of gifts, with the Honorable Joseph Mussomeli, the U.S. Ambassador to the Kingdom of Cambodia, presiding. A presentation by the Venerable Chhun Choeurn of the Wat Damnak on the second day enriched the understanding of the religious meaning and community significance of Phnom Bakheng.

Going beyond a traditional scholars symposium, the workshop required participants to consider a list of guiding questions in advance, prepare specialized presentations, and engage in a working session on the final day to define session outcomes.

The workshop was designed around the following questions:

1. How did the city of Yasodharapura, at the height of its prominence, support its local population? How was the agricultural production organized? What was the role of water? How was Phnom Bakheng situated within the city?
2. Which aspects of the site and its story are essential to represent it? What key ideas and facts should visitors learn during their visit?

3. How has Phnom Bakheng existed as a place over time? How has its physical condition been affected by recent wars and looting? By extremes of weather? By increased tourism?
4. How is Phnom Bakheng understood in the greater context of Angkor Park? How is it understood geographically, socially, and as a site of Khmer art and religion? What opportunities for interpretation of Phnom Bakheng exist beyond the immediate site itself?
5. What are the community, regional, and international dimensions of public interpretation of Phnom Bakheng? What is the appropriate level of community involvement in developing site interpretation and programs surrounding it? How is this site relevant to 21st-century audiences?

In this publication you will find many of the papers delivered at the workshop. These documents are valuable in themselves, and together they provide a holistic picture of Phnom Bakheng, which up until now was considered one of the least understood and explored of the major temple complexes in the Historic City of Angkor. Some of the papers that follow are reports of studies and investigations carried out in the effort to understand how the site is valued and the way it is used. Other papers present groundbreaking programs and new theories on the site's history, ideas that will shape not only interpretation at Phnom Bakheng, but our approach to other sites in Angkor Park as well.

As expected, with each presentation more questions arose, many of which were addressed in the workshop's final half-day session, a scholars roundtable. A full transcript of the roundtable discussion can be found on the Web site of the Center for Khmer studies, www.khmerstudies.org.

Outcomes

The scholars workshop focused on conversation, and indeed session chairmen were instrumental in beginning discussions with presenters in advance of the meeting. This collaborative structure, culminating in the final roundtable discussion, generated consensus on several key elements for the future management and interpretation of Phnom Bakheng. These include

Site significance

Most visitors come to Phnom Bakheng for its sunset views, but this narrow interest overlooks many aspects of the site that make it an exceptional cultural landscape within Angkor Park. Of these, two are outstanding: its relationship to its setting and its symbolic form. From its 70-meter summit, the temple-mound commands a view of the Siem Reap plain, the Phnom Kulen, and the park's other temples. Phnom

Bakheng is the first capital built in Angkor, and its layout provides a lexicon for understanding many developments in the succeeding three centuries—religious, agricultural, social, hydrological, and communal.

Protection of site integrity

Explosive growth in visitation, particularly by Asian tourists, demands in-depth study into site use and traffic patterns. Structural degradation throughout the site includes the temple monument and also the hilltop plateau, causeways, and eastern entrance area.

Site management structure

An optimal planning team for the site should be comprised of APSARA Authority personnel, consultants, community members, and an APSARA Authority project manager with cross-departmental access and authority.

Community engagement

Future plans for the site should take into account traditional knowledge and site use, the economic needs of residents, and community input in decision-making. An opportunity for capacity building exists in the multidisciplinary approach, which offers Cambodian university students direct exposure to experts in a variety of fields, including the arts and social sciences.

Enhanced natural resources program

The APSARA Authority's Department of Water and Forestry is completing a database of natural resources at Angkor and a plan for reforestation and vegetation management, in which Phnom Bakheng is being considered as a model site for showcasing natural history and reforestation.

Simulation and modeling as a planning tool

Computer modeling of historical terrain and the entrance area will facilitate decision-making for interpretation, visitor flow, conservation, and research activities.

Eastern entrance sequence

Restoring the traditional entrance would evoke the historic and religious sense of arrival to the monument. Recommended steps include continuing the archaeological research begun by the École française d'Extrême-Orient (EFEO) in the 1930s and identifying for visitors the perimeter moat, the causeway, and *gopura* (gateway). This effort will help to define the relationship of the arrival sequence with the greater Angkor Park program for visitor access areas.

Communication with the tourism industry

A marketing plan for Phnom Bakheng should promote the site as more than a sunset destination. Such a plan should be developed in consultation with tourism industry representatives and should include mechanisms for providing site closing and access restriction information in a timely fashion.

Conservation

Recent advances in conservation technology and materials testing should be applied. A designated conservation work area with interpretive signage could help visitors understand conservation objectives and actions; providing such public notice could improve visitors' sense of stewardship toward the site.

Phnom Bakheng as a pilot site for an integrated approach at Angkor

The APSARA Authority acknowledges the benefits of studying greater Angkor Park issues on a micro "site" level. As a site in the initial planning stages, Phnom Bakheng is positioned to serve as a case study for addressing issues of conservation, presentation, and management within the context of Angkor in the twenty-first century.

Advancing the Outcomes

Since the conclusion of the workshop in December 2005, three key workshop outcomes have been advanced.

1. Interpretation Advisory Committee

One of the most important advancements from the workshop was the formation by His Excellency Bun Narith, General Director of the APSARA Authority, of the Interpretation Advisory Committee in March 2006. With the participation of Deputy General Director His Excellency Ros Borath, APSARA department directors and their representatives, a liaison in the director general's office, and consultants, this unprecedented committee will provide a cross-disciplinary mechanism to test ideas and implement strategies. Its establishment marks a new integrated and balanced approach by the APSARA Authority: to look beyond the needs of conservation to include the needs of the visitors and communities.

2. Consultation with private-sector tourism representatives

In order to address increasing visitation at the site and the need to involve private-sector stakeholders in planning decisions for the site, the WMF, under the auspices of the APSARA Authority, held a series of meetings in March 2006 to begin a dialogue with tourism representatives in Angkor. Cooperation with tour guides, hotel managers, and tour developers enabled site and interpretive planners to better under-

stand visitation and tourism patterns and how to use interpretation to expand visit opportunities and tour routes. One of the major opportunities identified was the interest tourists have in seeing a site under construction. Presenting Phnom Bakheng as a work site to view conservation could also be enhanced by an interpretation scheme drawing visitor attention to the various stages in the conservation interventions.

3. Phnom Bakheng community meeting

On 23 March 2006, the APSARA Authority and interpretive planners from Jane Clark Chermayeff & Associates collaborated with the Living with Heritage team from the University of Sydney, Greater Angkor Project, to engage with representatives from the communities around Phnom Bakheng. Community members included six chiefs of villages, teachers, three monks, and the deputy governor of the district of Siem Reap. Issues and values discussed in this half-day open forum included the recognition of tourism as an economic engine, conflicts of managing a sacred place in a heritage park, and the dynamics of change in a rural agriculture-based economy.

Conclusion

By incorporating interpretation into site planning from its very inception, the WMF and the APSARA Authority have taken a bold step in their approach to Phnom Bakheng. Interpretation—with its multidimensional structure of defining site significance with all stakeholders, assessing visitor and user needs, selecting, testing, and implementing strategies—is now a foundation for all future planning and management decisions at the site. The outcomes of the Phnom Bakheng Workshop on Public Interpretation will serve as a tool for communication with planners and, it is anticipated, as an unprecedented model for planning at monuments throughout Angkor—planning that encompasses not only conservation but also the constraints and opportunities of tourism, the needs of the local population, and each site's multifaceted cultural and natural significance. Ultimately the goal of this integrated approach is to create a managed environment that enables visitors to comprehend and appreciate the centuries of human and ecological history represented in Angkor Park and to understand the sites' continued significance today.

Every visitor, indeed every generation, will ask new questions about Phnom Bakheng, will engage with the site in different ways. Each visitor will arrive with different expectations and desires of what the experience there will be. Creating opportunities for learning and engagement is one of the main conceptual challenges—perhaps the foremost conceptual challenge—at Phnom Bakheng.

Workshop Participants

U.S. Department of State

Ambassador Joseph Mussomeli, U.S. Ambassador to the Kingdom of Cambodia

Wat Damnak

The Venerable Chhun Choeurn

APSARA Authority

*H.E. Ros Borath, Deputy General Director, Department of Monuments and Archaeology 1 (DMA 1)

Khuon Khun-Neay, Director, Department of Monuments and Archaeology 2

Chau Sun Kérya, Director, Department of Angkor Tourism Development

Hang Peou, Director, Department of Water and Forestry

Cécile Califano, Landscape Architect, DMA 1

Tep Vattho, Director, Department of Urbanization

World Monuments Fund

John Stubbs, Vice President for Field Projects

John Sanday, Field Director, Conservation Program in Angkor

Jane Clark Chermayeff, Interpretive Planner, Principal, Jane Clark Chermayeff & Associates

Cheam Phally, Architect, Conservation Program in Angkor

Sam Kimheng, Architect, Conservation Program in Angkor

Michael Ellis, Cultural Heritage Planner

Chhan Chamroeun, Archaeologist, Conservation Program in Angkor

Prasanna Weerawardane, Assistant Site Director, Conservation Program in Angkor

Jill Gilmartin, Interpretive Planner, Jane Clark Chermayeff & Associates

Kusum Sarun, Administrator, Conservation Program in Angkor

Hem Sinath, Architect, Conservation Program in Angkor

Chhun Soma, Staff Architect, Projects Archivist, Conservation Program in Angkor

École française d'Extrême-Orient

Christophe Pottier, Director, Siem Reap

Fabienne Luco, Anthropologist

Center for Khmer Studies

Philippe Peycam, Director

Lesley Perlman, Deputy Director

Association des Amis d'Angkor

François Legrand, Vice President

Jean-Jacques Dupuy, Secretary General

Other Distinguished Presenters and Participants

*Pich Keo, Advisor to the Council of Ministers, Government of Cambodia

Claude Jacques, Historian, Director of Studies, École pratique des Hautes Études, Paris

Robert Acker, Department of Geography, University of California, Berkeley

Tim Winter, Asia Research Institute, Singapore

Hor Lat, Dean of Archaeology, Royal University of Fine Arts, Phnom Penh

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Phnom Bakheng Workshop on Public Interpretation Program

Organized by the World Monuments Fund under the auspices of APSARA,
Authority for the Protection and Management of Angkor
and the Region of Siem Reap

December 4-6, 2005

Center for Khmer Studies, Wat Damnak, Siem Reap, Cambodia

Pre-Workshop Orientation for Presenters

Sunday, December 4

2:45 p.m. Meet at World Monuments Fund House, Wat Bo Road, for site visit to Phnom Bakheng

3:30 Opening Statements

John Stubbs, Vice President for Field Projects, World Monuments Fund (WMF)

*H.E. Ros Borath, Deputy General Director, Department of Monuments and Archaeology 1 (DMA 1), APSARA Authority

3:50 Walking Presentation of Phnom Bakheng: Opportunities and Challenges

Presenters:

John Sanday, Field Director, Conservation Program in Angkor, WMF

Cécile Califano, Landscape Architect, DMA 1, APSARA Authority

Jane Clark Chermayeff, Interpretive Planner, Principal, Jane Clark Chermayeff & Associates (JCC&A)

5:45 Depart Phnom Bakheng for World Monuments Fund House

6:15 Reception and Dinner

Evening Remarks, Joseph Mussomeli, U.S. Ambassador to the Kingdom of Cambodia

Preview of the Workshop, Jane Clark Chermayeff, Interpretive Planner, Principal, JCC&A

Program

Monday, December 5 - Center for Khmer Studies

8:45 Welcome to Wat Damnak

Philippe Peycam, Director, Center for Khmer Studies (CKS)

9:00 Blessing Ceremony

The Venerable Chhun Choern and monks of the Wat Damnak

9:15 Workshop Welcome

Workshop Chairman: John Stubbs, Vice President for Field Projects, WMF

9:25 Program A: Interpreting Historic and Natural Sites / Applying the Process to Phnom Bakheng

Presenters:

Jane Clark Chermayeff, Interpretive Planner, Principal, JCC&A

Michael Ellis, Cultural Heritage Planner, WMF

10:00 Program B: History and Historiography of Phnom Bakheng

Presenter: Claude Jacques, Historian, Director of Studies, École pratique des Hautes Études

11:15 Program C: Goloupura: The Shape of Yasodharapura

Chairman: Philippe Peycam, Director, CKS

Presenters:

Christophe Pottier, Director, École française d'Extrême-Orient (EFEO), Siem Reap

Robert Acker, Department of Geography, University of California, Berkeley

Prasanna Weerawardane, Assistant Site Director, Conservation Program in Angkor, WMF

Chan Chamroeun, Archaeologist, Conservation Program in Angkor, WMF

2:30 Program D: Environment and Nature

Chairman: Jean-Jacques Dupuy, Secretary General, Association des Amis d'Angkor (AAA)

Presenters:

Cécile Califano, Landscape Architect, DMA 1, APSARA Authority

Hang Peou, Director, Department of Water and Forestry, APSARA Authority

4:00 Program E: Art and Architecture of Phnom Bakheng

Chairman: Jill Gilmartin, Interpretive Planner, JCC&A

Presenters:

*Pich Keo, Advisor to the Council of Ministers, Government of Cambodia

Jean-Jacques Dupuy, Secretary General, AAA

Hans-Georg Bock and Michael Winckler, IWR, University of Heidelberg

5:30 Brief Session Conclusions

Tuesday, December 6 - Center for Khmer Studies

9:00 Program for the Day

Workshop Chairman: John Stubbs, Vice President for Field Projects, WMF

9:15 Program F: The Local Community Today

Chairman: Khuon Khun-Neay, Director, Department of Monuments & Archaeology 2, APSARA Authority

Presenters:

Fabienne Luco, Anthropologist, EFEO, CKS

The Venerable Chhun Choeurn, Wat Damnak

10:45 Program G: Site Visitation: Profiles and Access

Chairman: John Sanday, Field Director, Conservation Program in Angkor, WMF

Presenters:

Tim Winter, Asia Research Institute, Singapore

Chau Sun Kérya, Director, Department of Angkor Tourism Development, APSARA Authority

1:00 Roundtable: Interpretive Opportunities at Phnom Bakheng

Moderators:

Jane Clark Chermayeff, Interpretive Planner, Principal, JCC&A

John Stubbs, Vice President for Field Projects, WMF

Participants: All Chairmen, Presenters, and Guests

3:00 Conclusions

7:00 Chairmen and Presenters Dinner

8:30 Special Evening Performance by the Wat Bo Shadow Puppet Troupe at Wat Damnak

* did not attend

History of the Phnom Bakheng Monument

Claude Jacques, École pratique des Hautes Études, Paris

The name Bakheng is relatively recent: it appears for the first time in inscriptions from the end of the sixteenth century, among which two have the date 1583 (see below). François Martini¹ studied the meaning of Bakheng: he isolated the prefix *ba*, often found in the names of temple-mountains, which, according to him, would come from the Austroasian substrate and would be associated with a “notion of power and especially of magic-religious power.” *Kheng* for its part is a Khmer word meaning “hard, vigorous, powerful”: it would thus be the “powerful *Ba*.” The author specifies that these are “suggestions that need confirmation and adjustment from specialists.” To my knowledge, the specialists have not yet given their point of view.

I. Ancient history of the site

Reigns that precede Yasovarman I

Christophe Pottier’s research-in-progress in the area of Roluos led to a certain upheaval in the history of this epoch. It is in fact now clear that the pyramid of the Bakong is appreciably older than we had thought and that it might have been established in as early as the second half of the eighth century. The two enclosures of that temple are in fact contemporary and date from around 750. Which king built it, we do not know, and we even have trouble proposing a name, considering the lack of epigraphic evidence from this time period; but we have known for a long time that, long before his coronation as *cakravartin*, Jayavarman II seized the throne of Hariharalaya (Roluos site), of which the Bakong was probably already the center. With his coronation in 802 on the Mahendraparvata (Phnom Kulen), where he seems to have taken refuge for a few years, Jayavarman II “created” the Khmer Empire. Afterward, we know little about his reign, except that he came back to Hariharalaya, that he certainly did not realize his dream of uniting the various Khmer States, and that he died around 835.

His son Jayavarman III succeeded him at that same site, apparently without trouble. The inscriptions indicate only two dates of his reign, 850 and 860. Jayavarman III was considered for a long time as a sovereign of little stature; it is true the inscriptions report only vivid stories of elephant hunts, but this trait was trivial for a king. We can nonetheless note in passing that he had the Prasat Cak built in the middle of a forest, after a wish concerning an elephant: this monument is hardly, as the crow flies, fifteen kilometers away from the Bakong and four kilometers from the future sanctuary of the Phnom Bakheng: it gives an idea of the landscape at the time.

It remains that, during a reign that might have lasted forty-some years, Jayavarman III might have had more importance than we suspected. Indeed he doesn't seem himself to have left any important work of architecture, but the scope of constructions should not be the only criteria of appreciation for assessing a reign, neither should lack of information bring about negative and more importantly definitive judgments: nothing tells us that the ever-possible discovery of inscriptions will not lead to an important change of opinion.

We do not know the date of Jayavarman III's death: as for most of the other Khmer kings, we set this date in 877, according to the accession date of his successor, Indravarman I. He was the son of Jayavarman III's maternal uncle, succession perhaps to be considered as "normal" in a country where matrilineal filiations are the rule. However, we would have expected one of his sons to succeed him; yet the epigraphy does not show it—which is normal if he was eliminated violently. The distant relationship between Jayavarman III and Indravarman I suggests that the succession must have been nothing but peaceable, Jayavarman III's death having occurred several years before 877. We also consider that Indravarman I—probably younger than Jayavarman III, but of the same age group—died in 889, only for the reason that it is that year his son Yasovarman I came to power; we will soon see that we have to push back this date a little bit. According to the chronology I have just expounded, Jayavarman II would have reigned thirty-three years, Jayavarman III forty-two years, Indravarman I only twelve years: yet it is to him that the most considerable monumental works were attributed.

Indravarman I ascended the supreme throne in A.D. 877. We credit him with three major works: the development of the Lolei *baray*—Indratataka, of which he probably did not build the northern dike; the construction of Prah Kôh—a temple dedicated to the kings who preceded him, whose history appears to be quite complex;² and the construction of the Bakong's temple. We saw that we had to push back the date of the beginning of this temple to more than a century earlier; Indravarman was content to face with sandstone a pre-existing laterite pyramid. Besides, his panegyrists do not mention the construction of the pyramid; on the other hand, they underscore the fact that he had the Indresvara³ *linga* installed at the top of that pyramid, in 881, and that he sheltered it in a stone sanctuary. This is the first time in Cambodia that a king thus placed his name beside the one of the *linga* of the state temple, protector of his empire. Nonetheless, he had to remove the god—whose name we do not know—that was placed there, installed by one of his predecessors.

The date given for the death of Indravarman I is usually 889, it being the year his son, Yasovarman I, acceded the throne. Yet we must note that, to this day, no

inscription mentions the king Indravarman living after 886;⁴ if we add to this that indeed it seems that a king, probably the son of another wife, designated as the heir by Indravarman, succeeded him before being supplanted by Yasovarman, we can suppose that Indravarman died not long after 886 and that fights for succession happened right in Hariharalaya, maybe even on the Bakong, fights the stelae of the Eastern Baray reflect. The destructions that then occurred because of these fights probably urged Yasovarman to leave Hariharalaya to establish his capital around Phnom Bakheng. Another reason might have incited him to do so: we know that in the same way Suryavarman I abandoned the state temple of Ta Keo used by Jayavîravarman after he defeated him; it is seemingly true that kings were not eager to establish themselves in places where the ones they killed had lived.

During a reign of slightly over twenty years,⁵ Yasovarman I accomplished a significant body of work. With his accession in 889,⁶ he installed *ashrama* in a large number of sacred sites, the location of some twenty among which we know from the famous “digraphic” inscriptions, bearing the same text engraved in the usual alphabet as well as in a new alphabet, which did not survive the king; we know in particular a number of them in the northeast of today’s Thailand. We therefore see that his domain was more considerable than that of his predecessors; he will moreover be celebrated later as follows:⁷

He [Indravarman I] had an incomparable son, glorious, who assumed the name of Sri Yasovarman, supreme master of the land that goes to the country of the Suksmakamrata,⁸ the ocean, China,⁹ the Campa, etc.

Moreover, he ordered hydraulic works of a grand extent: the completion of the Indratataka—in the middle of which he would erect, in the same year of his coming to power, the statues of the Lolei temple in memory of his parents—and especially the development of the large Eastern Baray, the Yasodharatataka, nearly four-and-a-half times wider than the Indratataka, as well as the network of canals that connect to it. He also had four *ashrama* built south of the great *baray*, one for each of the major religious streams, sivaïte, vishnuïte, and brahmanic—this last one including also some sivaïte, but focused more specifically towards the Indian philosophy—and Buddhist.

He finally established his capital around Phnom Bakheng, without our knowing the reasons for this choice: he would have the hill leveled in order to create a large esplanade, cutting the stone that would be used to form the structure of his state temple, faced with sandstone as the temple of Bakong. Around the principal divinity—erected, apparently, soon after 900—Yasovarman I would have 108 divinities

installed in as many sanctuaries, on the steps and near the temple's base, and probably also others in annex sanctuaries.

It is this king praised in stanza 29 of the inscription of Baksei Chamkrong, engraved under Rajendravarman's reign, around 950, and summarizing his important works: the temple of the Phnom Bakheng and the temple of Lolei, as well as the Eastern Baray:

On the five summits of a mountain that resembles the five summits of the Meru¹⁰ and on the surface of the island of the great ocean,¹¹ he has more than one hundred divinities installed; and he dug the Yasodhara reservoir.¹²

We can here pass on the Yasodharatataka and the temple of Lolei.

We found relatively few inscriptions on the very site of Phnom Bakheng, and no useful ones that are contemporary to the monument's construction. However, some texts coming from other sites enable the establishment of the main traits of this important monument's history, which marks the center of the first city of Angkor. We can quickly mention nine small inscription fragments in schist, discovered in 1933 at the pyramid's base, around the northeast corner, assessed under the number K.729. Cœdès attributed its writing to the seventh century. These fragments went to the EFEO Museum in Hanoi, where they were assessed under the number B 3,12, but they did not return to Phnom Penh as they should have: this is not a unique case;¹³ we must remember that the relocation of the pieces from Hanoi's museum to their country of origin, in 1954, was done hurriedly under the direction of Jean Filliozat. It is possible that they are still in some drawer of that museum, and it would be interesting to find out.

That said, I have trouble believing these fragments—which I have not seen—came from a local inscription. The inscriptions on schist—if the stone was correctly analyzed—are found only in the south of the country; these fragments would of course gain importance if it had been recognized as fact that the inscription they came from had been engraved right there, considering this supposed date.

One of the difficulties posed by the monument comes from the fact that, for a long time, we did not know the ancient name of this hill or of its temple and that we could say little about it, except that we observed that the monument's style was similar to the Bakong's and that it must have dated from around the end of the ninth century. We will further see that several years were needed before understanding what it really had been. Because of the K.235 inscription, engraved under the reign of Udayadityavarman II in the year 1050 and coming from Sdok Kak Thom,¹⁴ we knew as early as the end of the nineteenth century that Yasovarman had built a tem-

ple (called) *Vnam Kantal*, but we thought until 1930 that this “central mount” referred to the Bayon. This opinion reinforced the idea that the Bayon was of primitive art, attributed thus to the ninth century. It is only in 1930 that, with Victor Goloubew’s research, we would discover that Phnom Bakheng was this *Vnam Kantal*, this “mount of the middle” — “mount” being here applied to the pyramid as well as the hill itself and “middle” referring to the empire’s center. We were sure henceforth that the temple was thus built by the king Yasovarman I as was his state temple, marking the center of his capital and empire.

We very nearly had information, maybe even precise information, on the temple: indeed a grand stele exists, apparently engraved on only one side, but it is, alas, totally illegible: we cannot even figure out today if, as it should be, its text is engraved in the new alphabet, “of the North,” created by Yasovarman I, or if the alphabet was classical! The stele was probably sheltered under the eastern *gopura*, now disappeared. It was discovered in 1932 by Henri Marchal, but no one took notice of it: it is mentioned in only one report (April 1932); I myself brought it to the Cambodian inscription inventory, quite late, under the number K.1157. It can be seen there where Marchal set it upright, near the ruins of the eastern *gopura* of the temple. We can only hope that one day a miraculous technique will enable us to read its text, which is certainly likely to inform us on the beginnings of the sanctuary.

The inscriptions K.643 and 543 are described as two fragments of a same doorjamb, of which the central part would still be missing.¹⁵ They were found in two locations relatively far apart, brought there to be used in some monument. It could also appear that they were part of two doorjambs of the same door.

In any event, the texts seem to be indeed the beginning and end of a unique poem. The first part (that of K.643¹⁶) contains nineteen lines, forming nine *sloka anustubh* and a half, dedicated to the praise of Vishnu and its *avatara* (five stanzas), then to Siva, to Brahma, to a subordinate female divinity of Vishnu and one of Siva (one stanza for each divinity). We can notice that stanza 5 salutes Vishnu under the name of Pundarikaksa, specifying this god is (honored?) “on the Yasodharaparvata.”

The second part (that of K.543¹⁷) contains sixteen lines: it starts with the conclusion of praise for the mandarin of a king — we have the names of neither; it ends with the mention of the erection of a Pundarikaksa statue, undated; the last two stanzas contain the usual imprecations and benedictions.

Where do those fragments come from? Certainly from a temple specifically dedicated to Vishnu. To speculate on the title, if the discovery of the stone near the Prah Pithu X suggests a nearby monument, we could think about the small unnamed monument located east of the north Prasat Khleang; it is open on the west side and therefore was probably dedicated to Vishnu. This small temple is of a style similar

to the one of the Banteay Srei (around 970) and the writing of our inscriptions must be contemporary to it. This foundation could thus date from the last years of the reign of Jayavarman V, who, as we will see further, revived the Bakheng temple; a sanctuary of Vishnu was probably set there, under the name Pundarikaksa, which may be the source of this mention.

Another detail is introduced with the stele of Sdok Kak Thom, already mentioned. Its stanza 43 says:

On the hill of Sri Yasodharagiri which was like the king of the mountains by its beauty, he [the royal guru Vamasiva] had a linga of Siva established, at the invitation of the king.

And the Khmer text that confirms this:

Thus, S.M. Paramasivaloka¹⁸ established the royal city of Sri Yasodharapura and transported the devaraja of Hariharalaya in that city. Then S.M. Paramasivaloka had the central Mount installed. The lord of the Sivasrama established a holy linga in the middle.

In the Sanskrit stanza and the Khmer phrases we first have the certainty that Yasovarman had created the city of Yasodharapura. We can also see that *Vnam Kantal* refers not to the hill but to the temple where the installations (*sthapana*) of the gods were done. Finally, we must understand that the king, to honor his guru, asked him to erect a god, not in the central sanctuary, but most probably in one of the four towers elevated on the superior plateau.

This shows that the kings, in creating their state temple, must have invited the high dignitaries of the kingdom to join them by installing divinities. We have evidence of this practice with the inscription K.598, indicating in its stanza 22 that a dignitary erected a *linga* in the temple of Indresvara at a date that should be 805 *saka* (A.D. 883).¹⁹

Offerings could also be given at the temple, as the one mentioned in the inscription of the Prasat Prei Kmen K.774:²⁰

Under the reign of He who went in the world of Paramasiva, we inaugurated the central Mount; then we gave the servant named Tai Kanlan and four rice fields, a small house attributed to this servant given to the Vrah Kamraten An.²¹

We can also mention K.683, a small fragment with three odd ends of *pada* whose writing enables us to consider them as contemporary with the monument, found in the place at the bottom of the pyramid, on the west side: this fragment, whose text

is unusable as it is, remained, as those of K.729 mentioned above, at the Hanoi museum where it was registered under the number B 3,13.

Finally, we should point out that, in a famous article ("The symbolism of the Phnom Bakheng," published in the *BEFEO XLIV*, 529 sq.), Filliozat thought he had recognized an allusion to the temple of Bakheng in a stanza of Lolei's stele, installed in A.D. 879; however, this stele was probably engraved before the temple of Bakheng's consecration and this proposition is thus hard to acknowledge.

We have noticed, for a long time now, that a causeway, most probably built by Yasovarman I, united the northwest corner of Lolei's *baray* (Indratataka) and what we thought was the avenue leading to the east stairway of Phnom Bakheng. This causeway stops at the entrance of Angkor's park, because this region most likely underwent severe disruption after the beginning of the tenth century. All of the former maps of Angkor show this causeway, but the satellite images, SPOT in particular, show that the proposed layout was inexact.

In fact, the visible and rectilinear part of this causeway, if continued in a straight line, shows that it ended exactly on the side of the Siem Reap River, across from an old causeway that connects the southeast corner of Angkor Thom's enclosure to the river, a former canal. This ancient causeway, miraculously preserved, has been out of use for a long time. But we can see that before the construction of this enclosure, it could have corresponded to an entrance in Yasodharapura—or Golouppura, if you will—and that, compared to Angkor Thom's royal accessway, it could lead to the royal palace, located, as in Angkor Thom, north of the state temple. The only explanation is that it once continued to the royal palace, the same way as in Angkor Thom. I had asked Guy Nafilyan to express this relationship in the schema he did for my books on Angkor (Bordas, then River Books). Rather than wondering why there is no south monumental staircase, it is easier to think that besides the east and west stairs, one wanted to build one on the side of the palace.

It is likely that the monument was completed by Harsavarman I and Isanavarman II, sons of Yasovarman, but no evidence of this exists—we can notice only that Khmer monuments in general, as well as those of many countries in the world, have been modified over time.

There followed the episode of Koh Ker (928–940), during which the temple was apparently abandoned, at least as a state temple. However, we can read the name of the Yasodharaparvata in the K.187 inscription,²² with the date A.D. 930. But the name appears in a completely ruined context, and we can draw nothing from it.

After the fleeting reign of Harsavarman II—he too an "outsider" who had not been designated heir by his father—there arrived the supreme throne of Rajendravarman (944–968), first cousin of the previous king and king of Bhavapura, a kingdom locat-

ed around Sambor Prei Kuk, which he would integrate into the Khmer Empire. He was an admirer of Yasovarman, but he left no testimony on the Bakheng, which was yet probably his state temple at the beginning of his reign. Moreover, he would restore the little pyramid of Baksei Chamkrong, at the bottom and north of the Bakheng, before settling, near the temple of Pre Rup, the state temple he had built. It is under his reign that the name Yasodharapura appears for the first time in the epigraphy.

Besides, we have a mention of the *Vnam Kantal* in K.265,²³ with the date February/March 960, engraved on a doorjamb of the small temple of Lak Nan, forgotten although it is close to Pre Rup:

In 881 saka, fifth (day) of the (quinzaine of the moon) waxing of Phalguna, Sri Ranavikhyata who obtained the title of Sri Na--vira²⁴ respectfully informed the king (of his intention) to acquire this land of Sindura, belonging to His Majesty of the Vnam Kantal, to His Majesty Paramesvara, to the corporation of the kmap and to the corporation of the ancen to give it to Our Lord Sivalinga.

We can also read the name of the *Vnam Kantal* on K.690,²⁵ an inscription engraved on the north doorjamb of the south tower of the Prasat Trapéang Ropou, located in the surroundings of the Siem Reap airport. The text seems to have been engraved under the reign of Rajendravarman. In a ruined context, it is a question of "measurements of the land (*bhumi*) of Vnam Kantal."

The death of that reforming king was tragic: he was assassinated in 968, the year the temple of Bantay Srei was consecrated. His son succeeded him under the name Jayavarman V, and because Pre Rup and the neighboring palace no longer seemed accessible to him, he returned to the Bakheng. There we can read two inscriptions from him: K.464 is engraved on the east doorjamb of the central tower's north door and was discovered at the same time as the monument; K.558,²⁶ also engraved on a doorjamb, was not found in place as was K.464, but at the northern corner of the temple's higher terrace; it is likely that this doorjamb comes from a secondary tower of the flight above.

The purpose of these inscriptions is to recall the names of the servants assigned to the temple, after an introduction in Sanskrit and then in Khmer, identical in both texts. We therefore have sure evidence of the resumption of the cult at the beginning of Jayavarman V's reign, thus before he had the temple of Ta Kev built. Mentioned in passing are the rules decreed by Yasovarman I in A.D. 907, indicating the approximate date of the divinities' installation at the Phnom Bakheng temple.

We can also see that the name of the principal god of the temple is *Yasodharesvara*. None of the inscriptions indicates the name of the *linga* installed by Yasovarman I, which should have been Yasovarmesvara if it was built as Indresvara, for example. *Yasodharesvara* appears thus as a name given later on, maybe under Rajendravarman's reign, and would literally be the "Yasodhara(pura)."

The name of Yasodharaparvata can again be read on K.444,²⁷ a stele found "at the residence of Kompong Thom by Lunet de Lajonquière," written by Coëdès; we therefore do not know its exact origin. It reproduces an edict promulgated by Jayavarman V "in the city of Yasodharaparvata, at the stone holy basin—the location of which is unknown—with a date corresponding to Monday, 21 December 974. Three other inscriptions reproduce this edict: K.868, from the Battambang province, designates the city the same way, while the two others say, "in the capital of Yasodharapura." I commented on this passage in the *BEFEO* LXV, p.308-309: my conclusion was that the capital of Jayavarman V was still located near Phnom Bakheng in 974.

K.684²⁸ is an inscription engraved on a doorjamb, found in 1931 by Marchal "in the rubble" at the bottom of the pyramid, on the east half of the north side. The stone is seriously ruined and the inscription seems to have been defaced on either side (perhaps during the construction of the monumental Buddha). The writing is cursive, quite slipshod, and therefore difficult to date; it could have followed closely upon the temple's construction, unless it was cut during Jayavarman V's reoccupation. The god of *Vnam Kantal* is there mentioned as seller of lands to the god of Vrah Thkval—a toponym of unknown location—and consequently the beneficiary of fees: he was thus then in full occupation.

We can again mention the inscription K.521,²⁹ engraved under Suryavarman I's reign on the doorjamb of the Prasat Cak's two small sanctuaries (located between Siem Reap and Angkor Wat). At the end of the inscription (south doorjamb of the north tower), one reads the name *Vnam Kantal*, which here marks the northern limit of a parcel of land coming under this Prasat Cak.

Under this same reign, on the stele K.382,³⁰ B, 22 found at Prah Vihar, the main portion has been engraved with lines unrelated to this temple. But it must have been brought there under Suryavarman I's reign, and a few lines, quite ruined today, were added: however, in a ruined context, we find the mention of an event on the Yasodharagiri.

It is a question of the temple in some inscriptions: K.91, of Kuk Trapeang Srok (Kompong Cham),³¹ was engraved in the eleventh century and recalls the acquisition of a land close to the *Vnam Kantal* under the reign of Yasovarman I, according to archives of the lineage, however, in a defunct context and thus difficult to inter-

pret in detail. The *Vnam Kantal* is probably not precisely the temple here, but rather the capital.

Finally, we should point out the stele of Palhal, K.449,³² which evokes (stanza 41), in quite bad Sanskrit, a *Vnam Kantal*; here it is actually the pyramid of Koh Ker.

We apparently have no more mention of this sacred tie in the epigraphy after Suryavarman I (which of course does not mean it was abandoned).

The important works ordered by Jayavarman VII for the implementation of his capital, Angkor Thom, have inevitably modified the landscape surrounding this temple—if only the moats and enclosure—especially where the area of the palace must have been. Jacques Gaucher's research should help clarify our opinion on that matter. Besides, we also know that the road going from Angkor Wat to the south gate of Angkor Thom, a road that at least dates from this city's implementation, has cut the causeway of access to Phnom Bakheng and thus interrupted it: perhaps it was no longer used at that time.

Such a long history certainly caused a certain number of modifications, as is normal and as happened in numerous Khmer temples and those of other countries. It would most certainly be interesting to attempt this monument's history accounting for the strong probability and trying to date as precisely as possible, as far as possible, every element of the temple.

However, during the sixteenth century we have two inscriptions, K.285 and K.465,³³ that have a similar text concerning the restoration of Buddhist statues erected on the Phnom Bakheng. It is there that we can read the name of Bakheng for the first time:

May the success be! In 1505 of the great era, year of the Goat, eighth day of the crescent moon of the month of Jestha, a Sunday, Samtec Prah Racamuni Bapit came to erect a stele on this hill of Bakhen. He noticed that the old statues (of Buddha) were broken and in ruins. Samtec Bopit came to restore them. He painted them vermilion and gilded them. It was finished and well made. These statues were in number 26.

We can note that there is in this text no mention of monumental sitting Buddha built on the superior plate-form of the temple that has generally been attributed to the fifteenth or sixteenth century; we will see that this construction was probably of a much later time.

The date of A.D. 1585 is probably pretty close to the date—unknown—of the fall of Lonvek, capital of the South, and probably of Angkor into the hands of the Siamese. Moreover, we have found at Phnom Kulen, near the large Buddha, a stone—a former element of the top of an enclosure wall—cut with an inscription in Siamese,

K.1006.³⁴ It has no date, but it is clearly from the same period of time as the two previous inscriptions. It is from a Siamese dignitary of Ayudhya having come to Cambodia to visit various holy places, starting with the hill of Oudong (*Rajadraya*), near the southern capital of Longvek: after having saluted the king of Brah Nagar Hlvang—a name generally given by the Siamese in Angkor—he successively went on to the Bakheng, the Jetavana (Angkor Wat), and Phnom Kulen. We can be surprised that he visited the Bakheng before Angkor Wat.

Phnom Bakheng, before and after the brief Muslim interlude, which we will talk about, was the subject of a sort of Buddhist pilgrimage. A cult was practiced with numerous statues, evidence given by the inscribed stelae as well as the large number of *Prah patima* found in the debris, during several excavations.

Oddly, we found at Phnom Bakheng a stele engraved with an Arabic text, published as soon as it was discovered in the *BEFEO*.³⁵ A new interpretation by Professor Azedine Beschaouch³⁶ gives it more importance than we had thought, for he was able to read more words than Gabriel Ferrand, its first publisher.

We must recall that we, understandably, considered since its discovery that this stele dated from the apostate king, well known throughout the *Chroniques royales* under the name Ramadhipati or Ang Cand.³⁷ These late texts are not in agreement with the date of this king's consecration, which varies between 1693 (manuscripts P3 and P63) and 1665 (manuscripts B39/12/A).

However, Adhémard Leclère, whose *Histoire du Cambodge* is usually and rightly considered obsolete, here gives quite precise and additional information,³⁸ using the *Chroniques royales* as well as the notes of the Dutch tradesman Gerrit van Wuijsthooff, which enables Leclère to specify that this king had himself consecrated at the age of twenty-six and that he died in 1659 at the age of forty, "having reigned for about eighteen years."

Leclère calls this king Bautum-Réachéa II (*ponhéa* Chant, *sdach chaul sasna chvéa*, "the king who entered the religion of the Malays" or *sdach chénh sasna*, "the king who got out of religion"), Prince Chant before his consecration. Converted to Islam under the influence of a Malay wife shortly after acceding the throne, he had taken the name of Ibrahim. Beschaouch established that the stele recalls one of this king's triumphs: it seems he wanted to celebrate a victory won in 1646 over the Dutch, whose boats the new coreligionists had chased from the Phnom Penh harbor in order to facilitate their own commerce. In 1658, two princes, whose father Ibrahim had ordered assassinated, took up arms against him. Defeated, they took refuge with the queen, widow of Chey-Chetta (king from 1618 to 1628³⁹), who was Vietnamese. She contacted the king of Vietnam, who saw an opportunity to seize Cambodia. In October 1658, he sent an army and war started again. Ibrahim, defeat-

ed, was placed in an iron cage and deported to Vietnam, where he died the following year.

We can therefore estimate that the stele was engraved around 1650. It is unclear why this stele was erected precisely on Phnom Bakheng: an element of response is given by the *Chroniques royales*, manuscript P57:⁴⁰ the *oknha* governor of Angkor Wat would have escaped to Thailand with Ibrahim's partisans after his defeat and deportation. Angkor and its province were thus attached to this king, and we can from that moment imagine that a ceremony commemorating of the royal success happened on Phnom Bakheng, marking at the same time his victory in what was a sacred Buddhist location.

Jacques Dumarçay, moreover, has discovered in the middle of a basin dug east of the pyramid a Muslim grave, which most probably dates to the same period of time. Finally, we must note that the Arabic stele being found, as we will say further along, *in* the monumental Buddha's base, we have to believe this last construction [the monumental Buddha] was necessarily from after the stele and must from now on be attributed to the end of the seventeenth or even to the eighteenth century.

We cannot date the Buddhapada that has so impressed many nineteenth-century travelers, for it was the main religious monument honored at the time. It was guarded by Vietnamese monks, established there for the longest time.

2. History of the monument's conservation

We move now to the year 1860, when Henri Mouhot discovered the monument: the Khmers seemed to have abandoned in part the immense site of the former capitals; only the temple of Angkor Wat, flanked by its two pagodas, remained really alive. On the Bakheng's esplanade, there was only one Vietnamese pagoda, of which monks became the guardians of the Buddhapada, dug on the esplanade, in the middle of the eastern causeway. For Mouhot,⁴¹ the monument was above all a viewpoint, which he praised at length. We can moreover suppose that it was what he was brought there to see. Alas, things have changed little, and it is sad to have to report that a monument of such value is today used as a stepping stone!

The history of the discovery and research of Phnom Bakheng is exemplary for it shows the difficulty in understanding an ancient monument about which we know almost nothing from the beginning. The first obligation of those who work to highlight it should be to exalt its symbolism and aesthetics, while admitting that it can also be used to admire a landscape, in fact less interesting than what is often described.

Mouhot shows in passing a rather bad estimation of distances, which indicates that he was walking through the forest on winding paths, without perspective: "Two

miles and a half north of Angkor-Wat, on the path that leads to the city, a temple was established at the summit of Mount Ba-Kheng, about one hundred meters high." Further, he adds: "Six or seven kilometers northwest of the temple [of the Bakheng], lay the ruins of Ongkor Thom, (the) former capital."

Soon after, in June 1866, Angkor was visited by the expedition led by Doudart de Lagrée; on his part, Francis Garnier, assistant to the commandant, describes thus the top of the pyramid: "At the center of the superior terrace is a base of about 1 meter high, having 30 meters in the north and south direction, 31.50 meters east and west. It was on this base that the towers that overlook the surrounding land were elevated. Their examination enables one to recognize that there were three towers, facing east, and that the middle one must have been the most considerable. From the summit of these ruins, the view is ravishing: at the feet of the spectator stretches the moving dome of the forest, whose waves and indefinable murmurs come up to him."⁴²

The travelers who were to follow would not bring much to these first descriptions, with the same questions about the central temple and the same false answers.

The École française d'Extrême-Orient took charge of Angkor's preservation at the beginning of 1908. A few preliminary research works on Phnom Bakheng in 1911 are surely mentioned, but nothing of importance. Jean Commaille, the first curator, describes the monument in good place in his *Guide*:⁴³ "The temple of the Phnom Bak-Keng," he writes, "was elevated on a pyramidal base comprised of five superposed terraces. Of the temple itself we can say nothing, for it no longer exists. It disappeared for the most part in a deep cavity that can be seen by leaning above the heap of fallen rocks and that enables one to believe that the builders had dug a vast crypt under the sanctuary, for we must dismiss the hypothesis of a subsidence (of the ground) at a location where the rock is, that is to say, *à fleur de peau* (quite close to the ground)."

In order to enjoy the view, tourists start to climb up the hill, and that is why the EFEO had two trails—still in use today—created in 1919 or 1920, which provide an easier ascent than did the old eastern stairway. In the year 1920, however, one still wondered about what the Khmers had tried doing with the massive stone blocks that covered the last terrace. Henri Parmentier notes⁴⁴ that "the temple's pyramid, maybe with the hill itself, underwent a movement of subsidence in the southeast corner; it caused the ruin of some of the small pavilions that were on the steps and seems to have compromised the solidity of the central sanctuary built with a studied hardness not ordinary for the Khmers." Therefore he explains that the four doors of the central sanctuary "were closed by the construction of a huge belt of masonry that offered outside a sort of facing and was executed with care, using

sandstone blocks." He adds further: "The whole excavation will have to be done with great caution; the establishment of this belt is not explained in a precise way yet, and we don't know if, as it is likely, the catastrophe that it appears to be, has happened or is still to be feared."

The work of the *École française d'Extrême-Orient* on the temple of Phnom Bakheng, led by Parmentier and Marchal, would not really start until November 1922; it would last, for the first half of the work, until October 1925. They excavated principally the central mass and, at the same time, the small sanctuaries constructed around the pyramid, mostly collapsed and partly hidden under a heavy heap of earth. The task was considerable and the credits were meager.

Previously, in December 1920, Parmentier had dug an east-west passage through the central solid mass, fashioned to be able to penetrate directly in the tower, which was accessible until then only from its top, using a ladder. It was during this excavation that the Arab stele, previously mentioned, was discovered.

Charged with clearing the central mass of its vegetation and noting that this work would have to be done repeatedly because of the layer of humus that had settled over the centuries, Marchal decided in 1922 to remove the ground and the conglomeration of stone blocks which enclosed the tower "in order to avoid the return of this uncontrolled vegetation which made it dangerous to climb over the heap of fallen rocks to arrive at the top." It was then, and after a few months of work, realized that this considerable stone mass actually constituted the base of a monumental statue of a sitting Buddha, unfinished.

"At the Phnom Bakheng, the excavation of the pyramid which rises at the top of the monument made it possible to recognize a work analogous to the construction of the sleeping Buddha of the Baphuon. Here, the Cambodians of the late period tried to raise on this formidable throne a gigantic seated Buddha. It was never carved and undoubtedly even the mass of the torso was not built. The intention however is recognizable with the layout in the shape of opposite lotus cushions; it [the base] draws the shape of a large heart, which usually supports figures with crossed legs. Thus it explains the strange accumulation of material at the multiple crampions that, in such an odd way, surrounded the central sanctuary with four bays. Under this mass the four small corner *prasats* disappeared: a part of the western face of the northeast *prasat* was preserved in the mass of the legs of the Buddha."⁴⁵

The first photographs of the entirely excavated central sanctuary date back to April 1924. One was then able to understand that the platform on top of the pyramid carried five towers in quincunx arrangement of which remain, apart from the central sanctuary, only vestiges, still visible, from the northeast tower.

During this time, the excavation began of numerous smaller brick temples at the foot of the pyramid and the smaller sandstone temples on the steps, work also considerable even if it proved less rich in surprises. Work began again from 1929 until the end of 1931, then, more episodically, until 1935. Work consisted of excavating the small sanctuaries surrounding the foot of the pyramid from the enormous mass of earth that had accumulated; some of these sanctuaries gave the impression of having been voluntarily destroyed, without its being possible to propose a date. At the same time, one consolidated or one restored, when able, where it was necessary. It was during this period that the work of Victor Goloubew made it possible to place the monument in history. In association with Henri Marchal, he then made a good number of excavations and surveys in the city that he believed surrounded the hill of the Phnom Bakheng: even if the conclusions he drew have been revealed to be erroneous, all of this work was not useless; it brought to light numerous urban structures belonging to the following centuries.

In 1948, Marchal, then more than seventy-two years old, returned to Angkor to replace the curator Lagisquet; he remained the head of conservation until June 1949, before taking a definitive retirement to Siem Reap, where he died in April 1970. Aside from various works, notably on the small sanctuaries of the pyramid, he sought, without much success, alas, to find the stones of the corner *prasat* of the upper platform—particularly on the hillsides where, in the 1920s, he had the blocks of stone from the central mass discarded. It would undoubtedly be important to find these stones, if only to know if the five principle temples could be restored, at least in part.

Jean Laur had to intervene in (second part of) 1956 following the collapse of the southern wall from the first terrace. In July 1959, he noted new damage on the first tower north of the central staircase, on the western side of the first terrace. He then had to be content with stabilizing it before withdrawing from the conservation.

Rocks again fell at the beginning of the 1960s: Bernard-Philippe Groslier notes that it would be necessary to make a serious restoration, but he did not include it in an already full program. He settled with some clearing and installation on the northern staircase in 1969, following the restoration of the temples established at the bottom of the hill. However, it is necessary to note the large study of the monument made by Dumarçay, who published the plans of the temple in 1972.⁴⁶

To my knowledge, the first work that was made on the monument of Phnom Bakheng since the end of the serious events of Cambodia was clearing the undergrowth, carried out around 1994 at the request of a Japanese Buddhist congregation, under the direction of Ung Vong. Various studies were made there since, in

particular by the APSARA Authority, up until those of the World Monuments Fund, currently underway.

Important consolidation work and essential restoration has become urgent, and it is hoped that it will soon begin. However, much research will still be necessary to understand the history of Phnom Bakheng, which is far from having delivered all that one would want to know.

Notes

- ¹ "De la signification de "ba" et "me" affixes aux noms de monuments Khmers", *BEFEO* t. XLIV, 1947-1950, pp. 201-209.
- ² Christophe Pottier, "De brique et de grès. Précisions sur les tours de Prah Ko," to be published in *BEFEO* 92.
- ³ Stele of the Bakong K.826, edited by G. Cœdès.
- ⁴ Inscription of Bu'ng Ke K.495, edited by G. Cœdès, *BEFEO* XXII, p. 62.
- ⁵ The date of 900 often proposed as the date of his death is clearly erroneous; he died in 910 or very shortly thereafter. See "Sur les données chronologiques de la stèle de Tuol Ta Pec (K.834)," *BEFEO* LVIII, pp. 166-168.
- ⁶ Perhaps it would be preferable to say "official advent" because it is difficult to believe that it was carried out so quickly and could well have been prepared a few years before.
- ⁷ Inscription from Baksei Chamkrong K.286, stanza 27.
- ⁸ The name of this place is unknown: we could separate it out: *suksma* (with the suffix *ka*), signifies "end, subtitle" and also "cardamom," and *amrata*, the name of a mango and also of a mountain in the *Ramayana*. It is thus permissible to think of the Cardamom mountain chain.
- ⁹ Through today's Laos considered as Khmer, Vietnam was then Chinese. The borders of the Khmer country indicated here are found in more inscriptions, the oldest probably dating back to Jayavarman I.
- ¹⁰ This is the state temple of Yasovarman I, constructed on the top of Phnom Bakheng. Interpretation is slightly different from Cœdès, IC IV, p. 98 and note 2; this note was a comment by Filliozat, "Le symbolisme du monument du Phnom Bakheng," *BEFEO* XLIV, 1954, p. 552-553, and also by Groslier, *Les inscriptions du Bayon*, p. 159 and n. 2.
- ¹¹ In the middle of the Indratataka, where he built the Lolei temple.
- ¹² "Carrier of glory," pointing out the name of the king. It is about the Eastern Baray, the Yasodharataka.
- ¹³ There is also K.870, four fragments of a bronze inscription in pre-*nagari* writing (Inventory of the former EFEO Museum in Hanoi, B3, 10).
- ¹⁴ *BEFEO* XLIII, pp. 56-134
- ¹⁵ These fragments have been found: the first at the time of the excavation of the Buddhist terrace that is south of the Bayon, the second around the excavation of Prah Pithu X.
- ¹⁶ Published in the *BEFEO* XXIX, pp. 343-344.
- ¹⁷ Published in the *BEFEO* XXXII, pp. 1-5.
- ¹⁸ Posthumous name of Yasovarman I, abbreviated from the complete name that was found in K.774.
- ¹⁹ The digits of dates are frequently given as symbolic names, e.g., "eyes" for 2. In the present case, the symbolic name for units is *ardha*. Louis Finot, who edited this inscription (in *BEFEO* XXVIII, p. 58), understood the word *ardha* as units of two. Finot's explanation, however, is incorrect, and we must think that *ardha* here is an error of the stonemason (lapicide) for *artha*, which usually means five.

- 20 Edited in the IC IV, p. 64 (1. 10 to 12). This inscription bore the date of 21 May 995.
- 21 These last words are speculative.
- 22 It is engraved on the north rock face (interior) of the south wall of the *gopura* west of Prasat Thom, and the name appears in line 17.
- 23 IC IV, p. 102
- 24 We know the title of *Narendravira*, which would perhaps be suitable.
- 25 IC VII, p. 91.
- 26 BEFEO LVII, p. 58
- 27 IC II, p. 62
- 28 IC IV, p. 106. This *prasat* was mentioned earlier, in reference to Jayavarman III.
- 29 IC IV, p. 167.
- 30 IC IV, p. 270
- 31 Edited by Cœdès, IC II, p. 126 (1.6 to 9)
- 32 BEFEO XIII, (6), p. 27
- 33 Khin Sok, "Deux inscriptions tardives du Phnom Bakheng (K. 465 et K. 285)," BEFEO t. LXVIII, 1980, pp. 271-281.
- 34 Edited by Michael Vickery, BEFEO t. LXXI, 1982, pp. 77-86.
- 35 Gabriel Ferrand, "La stèle arabe du Phnom Bakheng," BEFEO XXII, 1922, p. 160.
- 36 Coming from *Manuel de l'épigraphie khmère*, vol. II.
- 37 See Mak Phœn, *Chroniques royales du Cambodge (from 1594 to 1677) ****, Coll. Of texts and documents on Indochina XIII, EFEO, Paris, 1981, pp. 187-200, and, for the notes, pp. 345-366.
- 38 *Histoire du Cambodge*, reprint of the 1941 edition, pp. 345-352.
- 39 According to A. Leclère (op.cit., pp. 368-340).
- 40 Mak Phœn, op. cit., p. 369.
- 41 Henri Mouhot, *Voyage dans les royaumes de Siam, de Cambodge, de Laos et autres parties centrales de l'Indo-Chine. Relation extraite du journal et de la correspondance de l'auteur par Ferdinand de Lanoye*, 1883 edition, pp. 197-199.
- 42 Francis Garnier, "Voyage d'exploration en Indo-Chine," *Le tour du monde*, [pub. separated, p. 45... also see in the journal the description of the Phnom Bachei/Vat Nokor].
- 43 *Guide aux ruines d'Angkor*, Paris, 1912, p. 104.
- 44 Chronicle of the BEFEO t. XX, no. 4, 1920, p. 208.
- 45 Chronicle of the BEFEO XXIII, p. 541.
- 46 Jacques Dumarçay, *Phnom Bakheng Étude architecturale du temple*, Mémoires archéologiques de l'EFEO no. 7.

Searching for Goloupura ¹

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For over a century of slow elaboration, knowledge of Angkorian civilization has been based on the sum of successive interpretations. Some of these interpretive hypotheses fell apart over the years, while others, fortunately, were reinforced by new information. Some of the hypotheses that were maintained, however, seem to owe their longevity to lack of confirmation as much as to lack of refutation. They are, in some way, "fossilized." That seems to me to be the case with Victor Goloubew's hypothesis, put forward in the 1930s, about the capital established by Yasovarman around Phnom Bakheng, "Yasodharapura I." Although the identification of Phnom Bakheng as a "temple-mountain" or "state temple" of Yasovarman now seems a certainty, the determination of the limits of Yasovarman's city seems less assured, although they have often been ratified since. It is a vast quadrilateral of four kilometers per side, which Henri Marchal nicknamed "Goloupura"²—a term that I will use from now on to designate the enclosure proposed by Goloubew around Yasovarman's city.

Nevertheless, the supposed layout of the city, generally considered the first capital in Angkor, has played a large role in propagating the image of the Angkorian city. This image is of a city rigorously conceived and surrounded by a square enclosure, reinforcing the idea of a geometrical model that is delimited and centered—similar, in fact, to Angkor Thom.

This ideal schema was contested belatedly by Bernard-Philippe Groslier in his article on the "hydraulic city" [Groslier 1979, 174, 182–183].³ But the controversy triggered by this text focused on its conclusions, obscuring, to some extent, the relevance of several paragraphs, one of which denies the existence of Yasodharapura I's limits as proposed by Goloubew. Nevertheless, Groslier's text is too brief to have substantially weakened the ideal image of Angkorian urbanism before Angkor Thom. Although some authors have also abandoned Goloupura since Groslier's article—without, however, justifying this abandonment—it is still frequently accepted, sometimes slightly modified, and persists in the landscape of Angkorian studies.⁴

Reconsidering the existence of Golopura some seventy years after its appearance, and more than twenty years after Groslier contested it, seems a relevant exercise, its repercussions being so topical, if only because determining the limits and morphology of Yasodharapura I is a prerequisite to visualizing the characteristics of Angkorian urbanism and territorial occupation at that time. Was it an open or enclosed capital? The first solution offers the possibility of reconsidering the super-

position phenomenon that can be seen at Angkor, as it enables us to emphasize the singularity of Angkor Thom's design compared to previous urban layouts.

I will limit my discussion in the following lines, therefore, to the appreciation of Goloubew's hypothesis on the basis of his own arguments and the analysis of the remaining vestiges, by placing them in their spatial and chronological context. We will thus see that several complementary approaches agree in denying the existence of Goloupura. This hypothesis having been abandoned, I will propose a new interpretation of some monumental vestiges and will attempt to draw a general picture of the boundaries of Yasovarman's capital.

The research of Victor Goloubew

The works of Philippe Stern and George Cœdès from the 1920s disrupts the established chronology of Phnom Bakheng and arouses new research questions. Among other issues, an immense gap appears at the end of the ninth century concerning the localization of the first Yasodharapura and of the mountain Sri Yasodharagiri (or Vnam Kantal), mentioned in the stele of Sdok Kak Thom [Cœdès and Dupont 1943–46, 208, 224]. Stern proposes, with reservations, that the Phiméanakas replaced the Bayon, which bore this role previously [1927, 56, 178–181], but this solution is not satisfactory, and Goloubew, from 1930 on, associates the Vnam Kantal with Phnom Bakheng [Goloubew 1933a, 320]. This identification is based not solely on the "style" of the Bakheng temple and its epigraphy,⁵ but also on the observation of Phnom Bakheng's position in relation to a corner of a double dike about two kilometers southwest (designated as CP807).⁶ Goloubew sees in it remains of a vast square enclosure, centered on the Bakheng, which would delimit the extent of the Yasovarman's capital [Goloubew 1933a, 322–323].

Verifying this identification through exploratory and excavation campaigns between 1931 and 1937, led by Goloubew with the active collaboration of Marchal⁷ and, occasionally, of Georges Trouvé. After a preliminary visit in October 1931, during which Marchal confirmed the presence of sanctuaries from the period investigated in the surroundings of Phnom Bakheng, Goloubew returned to Angkor from August to November 1932 and then from December 1933 to March 1934 to prospect in this zone and make several test excavations. The second mission took place in the immediate vicinity of Phnom Bakheng and around the Bayon, at the supposed location of the northern part of Goloupura. Two other missions were completed in this area, from April to August 1936 and from April to June 1937, which revealed several vestiges in Angkor Thom, few of which, it turned out, supported the original hypothesis. On the contrary, these findings led to the elaboration of a new hypothesis: the existence of a "Yasodharapura II" dating from the first half of the eleventh

century, the enclosure of which would correspond approximately to Angkor Thom.⁸

Many new structures and some sanctuaries were discovered during these investigations, essentially on foot. Although aerial surveys, which Goloubew introduced on this occasion in Angkor, emphasize the principal characteristics of the presumed urban layout of Goloupura in the rare areas without canopy, they mainly provide information on the major axes that guided the ground prospections and then excavations.⁹ The “urban question” driving Goloubew’s research led him to innovate by considering various types of remains, even very small ones, some of which would not have commanded or did not command attention previously. The notion of “archeological remains” broadens the research prospect to include non-monumental elements other than sanctuary ruins; for example, attention is paid to traces of former small constructions—dikes, ponds, *trapéang* (basins), earth mounds—and to their locations. Considering the number of elements discovered and the importance of mapping them precisely, topographers of the Geographic Service were hired for that task.¹⁰

The research undertaken by Goloubew to characterize Yasodhapura I schematically presents two facets, of which only the second relates to Goloupura and interests us here. Nevertheless, I will recall that the first, which represented “a great progress in our knowledge of Angkor,” [Groslier 1979, 174] concerns Phnom Bakheng and its immediate surroundings: it results in the identification of this *phnom* with the Vnam Kantal and also reveals an important layout at the bottom of the hill, contemporary with Yasovarman [Goloubew 1933a, 333-336; 1934, 580-588]. This finding was completed by Groslier’s research.¹¹ He observes a composition similar to the Bakong’s at Hariharalaya: a first moat “was dug at the foot of the volcanic hill. Stairs that lead to the temple were rising from the median axis; there the causeways that led to it stopped.... A second ditch, even larger, mirrored it some 120 meters outside.... These two ditches contain a series of satellite sanctuaries” [Groslier 1979, 174].

The second facet of Goloubew’s work focuses on the limits of Yasovarman’s city, Goloupura, and in particular on the structural elements of the urban layout—as Goloubew saw it—that is, mainly the causeways and the enclosure.¹² This facet follows directly from his original hypothesis, elaborated as early as 1931, of a city centered on Phnom Bakheng and delimited by a vast enclosure of more than sixteen square kilometers. At the end of his second campaign, Goloubew emphasized that “long before the first pickaxe struck [he was] able schematically to set the principal elements of the first Yasodharapura. In other words, it was not a matter of discovering an unknown city, but of controlling, on the as yet unexplored field, a set of

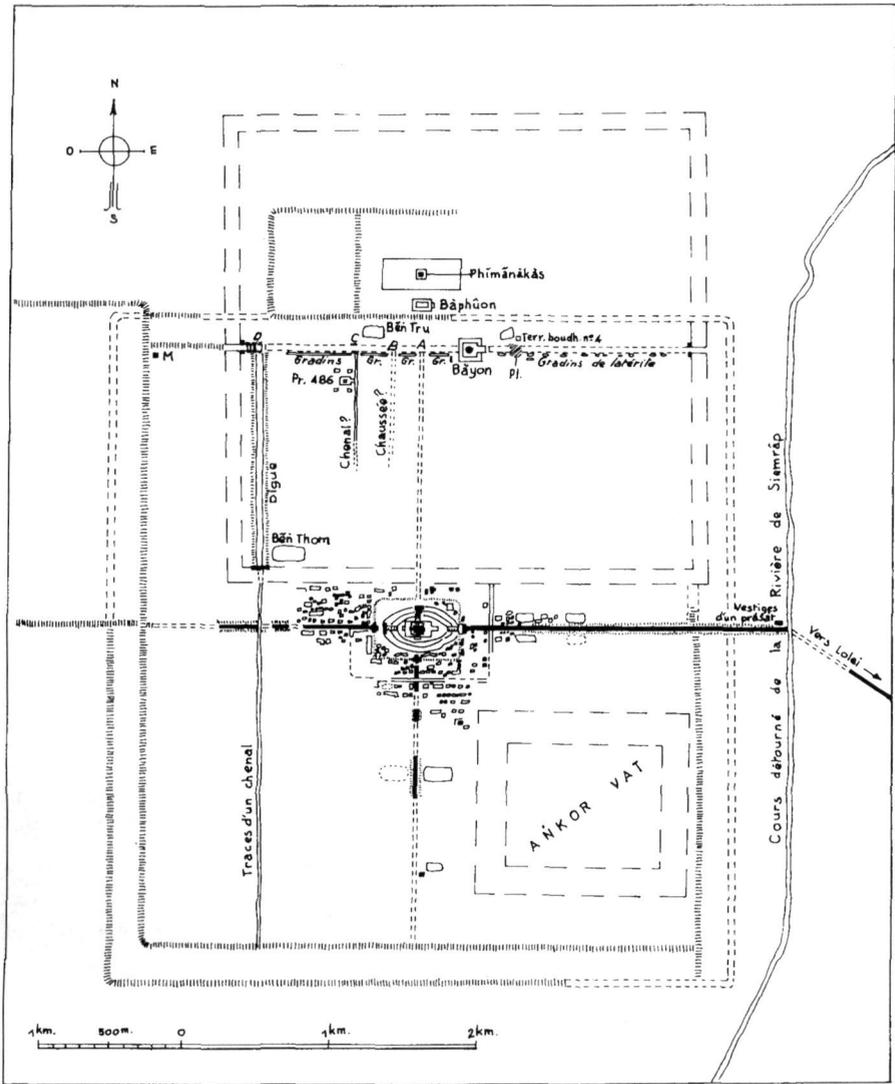
information determined by this reasoning" [1934, 600]. This "control," achieved through prospections and excavations, reinforced Goloubew's point of view, which can be summarized as follows (see map 1):

- Goloupura's enclosure is built as the vestiges of earthen embankments (CP807) located south and southwest since the first precise mapping of Angkor in 1908, i.e., a two-hundred-meter moat surrounded by two high, wide parallel dikes, which we will call the *interior* dike and *exterior* dike.
- Angkor Thom's east-west median causeway, the dike bordering the eastern side of Angkor Wat and the eastern bank of the Western Baray, are seen as vestiges of the *interior* dike of Goloupura's enclosure [1933a, pl. III; 1934, pl. XIII].
- The south side of the earthen embankment enclosing the *trapéang* Daun Meas (west of the Royal Palace) and bordering the Baphuon, as well as an east-west dike joining the surroundings of the northeast angle of the Western Baray, are considered to be the only remains of Goloupura's *exterior* dike [1933, 336–340].
- Four axial causeways radiate from Phnom Bakheng, whose extremities he envisioned as joining at least the *interior* dike of Goloupura.

A late logic of assemblage

This diagram leads to a first series of "general" commentaries on the organization and assembling of the constitutional elements of this Goloupura and on its context. First, a general thought on Goloupura's plan: From the start, Goloubew had considered the Bakheng as the geometric center of the city's plan. But the research of elements likely to correspond to vestiges of Goloupura led him to admit an important decentering of the Bakheng (see map 1). To justify what he considered an "anomaly," he relied on the opinion of Henri Parmentier, who considered some of the enclosure's clear decentering as common in the Angkorian plans. If Parmentier's remark finds justification in many temples, it is not so evident in "urban" developments: examples of cities with an exterior enclosure are in fact too rare to generalize.¹³ Nevertheless, even if we were to retain Parmentier's point of view, the original centrality of Phnom Bakheng is distorted in the final diagram because it has been adapted to the few vestiges evoking the double embankment and Goloupura's moat.

In addition, the two dikes (CP807) at the origin of Goloubew's hypothesis are presented in a context the logic of which seems connected to other works later than the Phnom Bakheng period. Groslier had already noted that aspect in order to propose a later date for the double embankment CP807 [1979, 182]. Although Groslier's explanation about the *functionality* of CP807 seems unconvincing (see below), this category of argument opposed to Goloupura should be remembered. The location



Plan 1 – Plan de la ville de Yaśovarman (Ankor I)
 d'après les travaux de V. Goloubew et H. Marchal (décembre 1933 - mars 1934).
 (publié dans le *BEFEO*, 34/2, 1934)

of the various elements in relation to one another (see map 3) and the spatial coherence—or even the logic—that resulted from this location brought forward a relative chronological relationship. To the east, the dikes of CP807 end against the north-south dike bordering Angkor Wat's eastern *moat* and continue south for 150 meters more before turning back to zigzag across the Siem Reap River and continuing east (CP806).¹⁴ This abrupt stop of the “enclosure” CP807 at the north-south dike bordering Angkor Wat suggests that the first one is contemporary with or later than the second, and therefore with the temple itself, if we consider it connected to this dike. At the other, western, end, the “enclosure” CP807 connects to the southeast angle of the Western Baray. The aerial photographs show no sign of an eventual prolongation of the exterior dike in the *baray* perimeter, which is dry in this area. It is therefore very unlikely that the *exterior* dike ever existed. Besides, although the eastern dike of the *baray* and *interior* dike of CP807 connect, they do not have the same section¹⁵ or exactly the same orientation. The aerial photographs and topographic map indeed show a small but noticeable difference (more than 1°) in their orientations, suggesting that these two pieces of work belong to different projects. The configuration of that area suggests that CP807 connected to the corner of the *baray*, and thus postdates it.¹⁶ A first examination of CP807's context, at the Goloupura's most visible *angle*, leads toward denying Goloupura's existence by attributing a date much later than the tenth century to the creation of CP807.

Absence of archaeological remains

A second, more detailed examination is necessary to evaluate the existence of Goloupura: the analysis of the archaeological remains that can be spotted along the supposed layout of Yasovarman's city. One must note the paucity of discovered remains, even the absence of convincing elements. So indicates Marchal's journal as he was closely following Goloubew's research.¹⁷ This “absence” or “lack” has led some authors to propose several amendments to the original sketch, yet without calling into question Goloubew's central hypothesis. Thus, it was suggested that important sections of this enclosure had never been finished or even started [Boisselier 1966, 102–103], or that the enclosure was composed only of one dike—the *interior* dike—and one *moat* [Jacques 1978, 291]. This poverty of archaeological remains and their absence on the sections reconstructed by Goloubew constitute, of course, a persuasive argument, which Groslier did not fail to raise in contesting all of Goloupura [1979, 182]. The fact remains that the detailed examination of these remains has not been pursued or revisited since the 1930s.

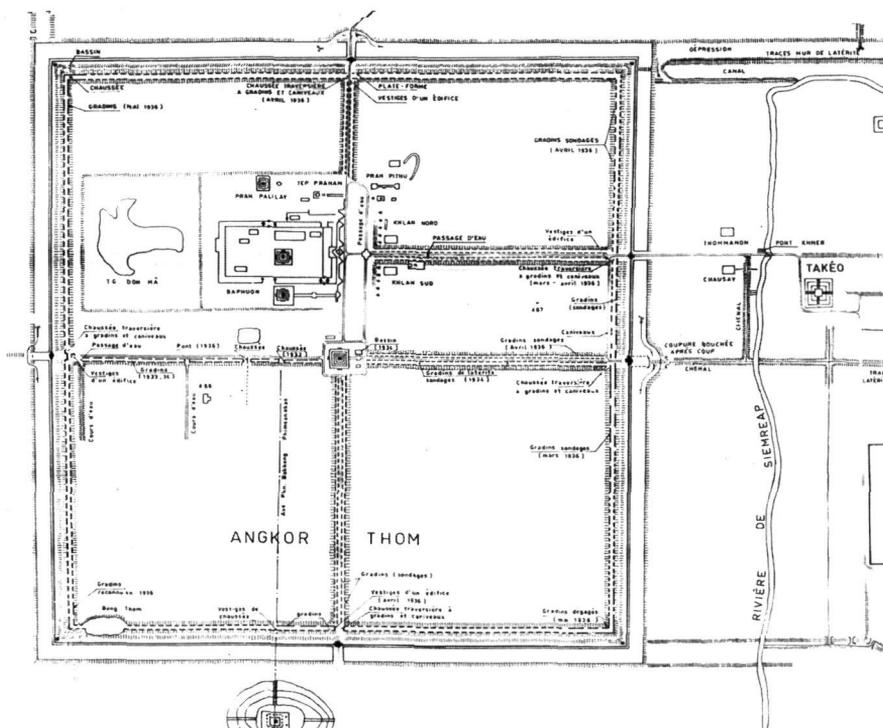
Despite its tedious aspect, we will undertake this examination of the Goloupura layout, in a trigonometric direction from Angkor Thom, coupling together the

“raw” information gathered by Goloubew and Marchal with our analysis of the aerial photographs¹⁸ and recent maps,¹⁹ completed with observations from our field reconnaissance.²⁰

North side

The elements collected in Angkor Thom by Goloubew (see map 2)²¹ consist mainly of causeways and canals often faced with laterite blocks. Difficult to date without additional information, these remains show an organization that appears to be related that of Jayavarman VII's capital, rather than to a previous eleventh-century capital, even less to one of the tenth century. Also, following the example of Goloubew [1933a, 336–337] and considering the present causeway on the east-west axis of Angkor Thom as a vestige of the *interior* dike of Goloupura forces one to neglect a number of differences between the two linear structures, such as a difference in width from one to three.²² It seems likely as well that the archaeological remains discovered at the junction²³ of Bakheng-Phiméanakas and the west Bayon causeway, interpreted by Goloubew as evidence “of the highest importance” of the existence of a first north causeway of Goloupura [1933a, 332–333; 1934, 588 and fig. 12], may be nothing more than a particular element—but not unique—of the laterite-faced canal bordering the Bayon causeways.²⁴ Finally, it is difficult to follow Goloubew's interpretation, which identifies a trace of Goloupura's *exterior* dike in the dike bordering the southern side of the Baphuon: all of the authors, including Goloubew, consider it later than this temple, and no earlier evidence has yet been found there [1933a, 338].²⁵ The examination of Goloubew's research allows us to report, as Groslier did, that the numerous elements discovered bring no confirmation of the existence of the northern layout of Goloupura.

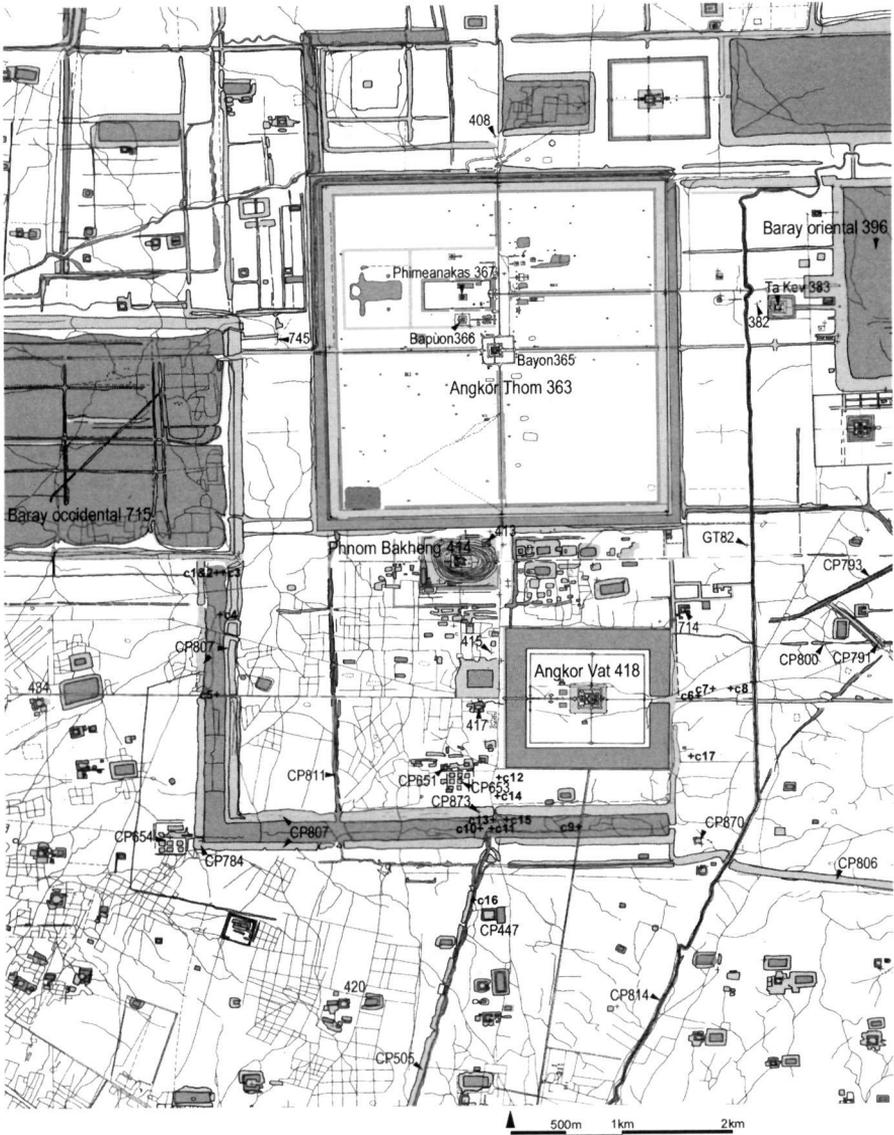
Close to the northeast corner of the Western Baray, Goloubew had surveyed the extension of Angkor Thom's causeway to the *baray* and, in the brushwood, a section of an east-west dike, possibly a vestige of Goloupura's exterior dike [Goloubew 1933a, 339; JF 9:62]. This area having been much cleared, it is now easy to see that this section exists, but extending a length of only three hundred meters from the baray dike, then turning back north and meeting another east-west dike, two hundred meters farther, that borders a channel to the north. Aerial photographs and topographic maps made since 1992 show that the section follows a direction that is not parallel to the Angkor Thom causeway. All of these embankments thus form what could have been a reservoir of 300 by 200 meters, now dry, situated side by side with the eastern side of the corner of the *baray* with which it could have been connected.²⁶ We are far from the remains of a double dike.



Map 2

West side

In the sketch proposed by Goloubew, the eastern dike of the Western Baray partially covers up the interior dike of Goloupura. Of course the present volume of the dike permits such a hypothesis, although it seems more difficult if one considers that a first—potentially narrower—dike existed originally during the eleventh-century and was raised and enlarged later on [Dumarçay 1982: 103]. On the other hand, as I previously mentioned, examination of the aerial photographs shows without ambiguity that no exterior dike existed prior to the *baray*: even if it had been destroyed and meticulously flattened, such a dike would have without doubt left a signature at the bottom of the *baray*, dry in this area and therefore perfectly visible on the aerial images. Besides, as Claude Jacques noted, “it is obvious that, if the exterior embankment had existed where Goloubew locates it, in the Western Baray, it would have been used as the eastern dike of the *baray* and not the portion equivalent to the interior embankment” [1978, 292].



Map 3

Goloubew noted a few sections of the west axial causeway of Phnom Bakheng and considered it “likely” that this causeway continued to the *baray*, or even further west [1933a: 331]. His general layout of Goloupura [1933a: pl.III] shows indeed two sections, one starting at the bottom of the *phnom*, the other finishing south of the Angkor Thom moat’s southwest corner. He also indicated the beginning of the causeway at the *baray*’s southeast corner²⁷ (see map 1). At present, nothing confirms the existence of such a vestige of a causeway at that location, either in the field or in the aerial photographs or on the topographic maps. On the contrary, these three sources concur to suggest that the west axial causeway of Phnom Bakheng stops four hundred meters before reaching the *baray*.²⁸ Thus, it seems that this causeway never reached the interior dike of Goloupura.

South side

South of the southeast corner of the *baray*, we now reach the two dikes CP807, the earthen embankments that make the “southwest corner” of Goloupura and a “model” to which we can compare the other reconstructed sections. These dikes had been explored, on elephants, by Marchal and Goloubew in November 1931 “to find out if, as in the Eastern Baray and at the corners of Jayavarman VII city’s enclosure, any pavilion or inscribed boundary stones did not rise there, this southwest corner being the only one we can very clearly locate” [RCA 11/31]. Although this area is considered one of the less altered, and therefore a source for more evidence, Goloubew and Marchal had trouble finding a few scattered fragments.²⁹ At the time, Marchal considered that “although none of these fragments seems convincing for Goloubew’s theory, they confirm the possibility of an ancient *prasat* at this location built during the reign of Yasovarman.” Nevertheless, the test pits he made two months later did not give any result apart from the localization of other rare and scattered blocks, obviously moved, at Srè Daun Sâr CP873. This led Marchal to doubt the existence of any structure at the corner of CP807.³⁰ The result of my own reconnaissance on CP807 had a similar result: only a few irrelevant bricks and potsherds can be noted near the exterior corner CP784. But these artifacts do not indicate any structure, not even a real occupation of the dikes, for they could have come from some earlier occupation, moved with the soil volume piled up to construct the dikes themselves (see below). Finally, the rare fragments found in 1931 can even suggest a later date for the CP807 dikes.³¹

The detailed topographic maps also permit us to put forward several comments on the CP807 configuration. It appears that the two CP807 dikes do not share the same section in relation to one another,³² and that the interior dike is less wide at its east-west section than its north-south return toward the Western Baray [Garami and

Kertal 1993: 36 and fig. 34-35]. Furthermore, the distance that separates the dikes is slightly, but noticeably, different: 310/300 meters on the western side and 290/280 meters on the southern one (distance between the summits), an unexpected difference if the two dikes and the “moat” had formed an enclosure.

The field surveys have also led me to discover a new site, Kôk Daun Bos CP654. Located at the southwest corner of CP807, it seems no longer to show any structural vestiges, but it has a particular configuration³³ not found in the Angkor region except at the CP653, where vestiges of a much later monastery are present. The similarity between the two sites also applies to their localizations: CP653 is just west of the southwest corner of the Angkor Wat moat, exactly as CP654 is in relation to the corner of CP807. Interpreting this similarity, however, is clearly premature without further investigations on both sites. Therefore we will only underscore the possible connection between Angkor Wat and CP807 via the existence of a special configuration at their southwest corner.

Before we tackle the eastern side of Goloupura, we should mention once more that the southern causeway of the Bakheng, vestiges of which we came upon up to the height of Angkor Wat’s western axis,³⁴ seem not to continue farther south. Goloubew seems to justify this disappearance by considering that “the construction of the road to the south gate to Angkor Thom had led, early on, probably as soon as the end of the twelfth century, to the abandonment of the causeway established under Yasovarman” [1933a: 332]. Nevertheless, it is doubtful that such abandonment could be the cause of the disappearance of every trace of that causeway, as this could not possibly have been used for the one in Angkor Thom, 350 meters away. Again, the aerial photographs confirm the cartographic information and the field observations, and indicate that the southern causeway of the Bakheng may not have reached the south side of Goloupura.

East side

The eastern side, the last side of Goloupura, is where Goloubew found the fewest vestiges. So few that following Parmentier’s advice, he considered that the exterior dike might “not have been planned by Yasovarman and his technical advisors, the capital’s protection being provided, on the east side, by the diverted course of the Siem Reap River” [1933a: 340]. Besides the fact that we have reason to believe this river was canalized—or even created—far later than the tenth century [Pottier 1999: 100-101 and 168], its defensive utility is questionable: Yasovarman’s “technical advisors” could hardly have been satisfied with this easily crossed canal—shallow and narrow, less than thirty meters wide—without any particular embankment. Moreover, reconstructing a moat built around the interior dike of Goloupura comes

up against the existence of at least two sanctuaries built on its supposed extent: an unnamed site CP870 at the extremity of CP807's south side, near the southeast corner of Goloupura,³⁵ and of course Kapilapura 714, northeast of Angkor Wat.³⁶ In fact, it is clear that none of these elements allow us to reconstruct the presence of an *exterior* dike, not even a single *interior* dike on that side. Goloubew's sketch relies essentially on the existence of only one *interior* dike, associated with the gentle dike bordering the eastern side of Angkor Wat's moat,³⁷ and continuing a little farther to the north. Surveys are still difficult in that area covered with thick undergrowth, and the aerial images as well as the topographic maps are imprecise. Nevertheless, the topographic survey done in 1934 showed that this earthen embankment tends to blur off to the north and continues no farther than Phnom Bakheng's eastern axis; from there, only a single dike runs north to the southern moat of Angkor Thom, but it is "20 to 30 meters" out of line to the west [Goloubew 1934: 599]. Farther north, Goloubew "hesitates to see in the [embankment behind the eastern wall of Angkor Thom] the prolongation toward the north [of the *interior* dike, because it] seems to have rather affected a line corresponding to the *exterior* side of the moat, to the east of Angkor Thom" [1933a: 340]. There are no convincing vestiges of Goloupura's eastern side, and the only embankment of some importance, in Angkor Wat's surroundings, is closely associated to this temple, and is therefore probably contemporary to it or later.

Finally, on this eastern side, the existence of a long causeway in Phnom Bakheng's axis seems more likely. Goloubew had fully explored and reconstructed it up to the Siem Reap River. He relied significantly on the discovery of the "remains of a *prasat*" GT82 near it, hastily interpreted as a sanctuary devoted to the Gangā cult [1933a: 326-330]. The topographic maps done in 1934 show that this site was not indeed located in Phnom Bakheng's axis, but 150 meters north of it [1934: 599; RCA 02/34]. Moreover, none of his discoveries imply that the river existed at the time of the vestiges, which, although they are close to the river, are not particularly connected to it. At the same time, Trouvé surveyed the area east of the river and showed that the axial causeway might have continued east and met a causeway CP793 leading to Beng Mealea [1933: 1124-1126].³⁸ Finally, it seems that Phnom Bakheng's axial causeway might have existed and extended east, but did not show any particular development at the junction with the river, or with the layout of Goloupura.

At the end of this detailed examination of the remains of Goloupura's enclosure, one must agree with Groslier when he interjects that the "supposed northeast layout, along the entire north and east sides, does not exist, and nothing gives even the slightest confirmation" [1979: 182].

Stratigraphic data

The region surrounding Phnom Bakheng has been occupied for a long time, and it is most likely that a number of tenth century structures have been profoundly altered or covered up by the later occupations, especially during Angkor Thom's period. If we can advance this explanation to justify the disappearance of a few sections of Goloupura, it is unsatisfactory considering such a scarcity of vestiges on the ground, unless stratigraphic evidence unequivocally reveals former stages. Unfortunately, no information of that nature was collected in the 1930s. We can mention only what Marchal noted about the remains discovered by Goloubew, south of the western causeway of the Bayon: these structures, in addition to being "vague," were all "very close to the ground, not even 0.50 or 0.60 [meters] of soil to be taken off" [JF 10; 31]. He believed this remark constituted an objection against connecting these vestiges to the tenth century. However, Marchal's argument cannot be entirely accepted because it compared this shallow depth to a deeper one observed at the royal palace's enclosure, about which we have since learned that its stratigraphic thickness is not representative of the rest of Angkor Thom.

Nevertheless, the absence of traces of Goloupura on the surface could be circumvented by stratigraphic information likely to have kept at least the memory of a moat. Groslier asserts in this connection that "the many stratigraphic excavations done from the Bayon to the Leper King [terrace], between 1960 and 1972, have never revealed any "northern moat" of Yasodharapura, which would not have failed to appear" [1979: 182]. Considering the amplitude of Groslier's work in that area, we will take into account the weight of such an argument, even though these stratigraphic sections remained unpublished, except for those of Jacques Dumarçay's excavations in the Bayon [Dumarçay and Groslier 1973: 17-21, pl. XI-XII]. In this case, the pits' stratigraphy shows no trace likely to support Goloubew's hypothesis.³⁹ Recently, Richard Exaltus completed core-drilling campaigns within the Angkor Thom enclosure in the framework of an archeological research program, "From Yasodharapura to Angkor Thom," directed by Jacques Gaucher. These cores suggested the existence of a former stream, south of the Baphuon and in the vicinity of the Bayon; but this body runs north-south, largely meandering, and does not correspond to any possible north moat of Goloupura [Gaucher 1966: 12 and pl. 5; 1997: pl. 5]. The available stratigraphic indications tend to question the existence of Goloupura's northern part.

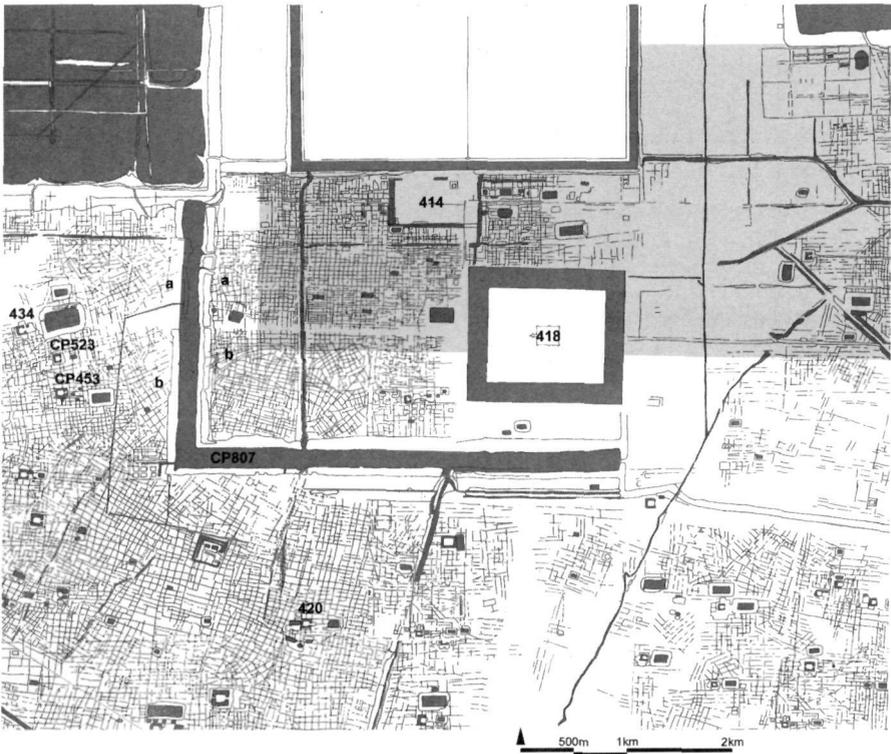
No stratigraphic data seemed to exist concerning the remaining parts of Goloupura's moat. Then, during a campaign of experimental core-drillings completed within the preliminary phase of the Greater Angkor Project, Roland Fletcher and myself completed a few cores at several locations of Goloupura's supposed

moat, in December 1999.⁴⁰ The limited number of cores provided us only a very narrow vision and therefore a partial understanding of the stratigraphic sequences of the investigated areas. Besides, because the nature of the soils and their rapid transformations in the tropical environment can lead to the disappearance of most of the non-architectural occupation traces, a certain caution is essential in the interpretation of the data recorded. Still, among the cores drilled between CP807's dikes (see localization on map 3), several have been conducted south of the Western Baray's dike in order to search for traces of the two sedimentation periods that could have supported the idea that the reservoir came later on, in Goloubew's hypothesis (c1 to c4): they showed no such thing. Besides, no trace of a moat is perceptible in the eastern side's cores (c6 to c8 and c17). The ones completed on the south and west sides of Goloupura's moat revealed only a level of colluvium (c2 to c5, c9, c10 and c15). The two cores located in the canal CP505's prolongation showed a very specific sequence below the bottom of the moat, suggesting that the canal predates the moat (c11 and c13, see below). The results of these coring campaigns reveal no characteristic sign that could support Goloubew's hypothesis; on the contrary, they provide elements that designate the work CP807 to a much later period of time (see below).

Ancient banded fields and epigraphic data

Elements of another nature introduce more arguments contradicting Goloupura's existence, and more specifically the presence of CP807 during Yasovarman's time. The analysis of several sets of aerial photographs taken since the 1930s show the presence of a geometric field pattern caused by the Eastern Baray and located south of it; I consider that in most of its parts this parcel pattern is contemporary with the *baray* [Pottier 1999: 117-119]. This mass of banded fields continues west until it includes Phnom Bakheng and spreads west and south for 1,500 meters (see light gray on map 4). This group of banded fields is isoclinic, and therefore contemporary with the Bakheng.⁴¹ But it does not join with the CP807 dike, neither the western and southern sides of Goloupura. In the remaining sections of the supposed city enclosure, the parcel division is almost never associated with—and generated by—the *interior* dike, a morpho-chronological context that should be common if CP807 had been a city's enclosure. Actually, traces of the parcel division seem mostly independent from CP807. Moreover, in at least two places to the west, these pattern fragments appear in continuity with other parcel groups from outside of the "enclosure" (see a and b on map 4), indicating that these banded-field groups, cut and partially obliterated by CP807, predate Goloupura.

We here have the opportunity to find in the epigraphy confirmation of our remote-sensing analysis. At Prasat Trapéang Ropou 434 and Prasat Kôk Châk 420, two temples next to the *phnom* and located outside of CP807, the inscriptions reveal ground limits adjoining the ones of the Vnam Kantal (Phnom Bakheng). This coincidence is fortunate enough and allows us to go through the detail of these two inscriptions in order to find any possible allusion to CP807's two dikes, a noticeable topographic feature that, had it existed at the time of the inscription, would surely have been mentioned when delimiting the grounds of Vnam Kantal and their surroundings.



Map 4

Prasat Trapéang Ropou 434

This temple, dated from its remains to around the end of the tenth century, bears two inscriptions with known dates: K.691 on the door frame of the “library,” which recounts “the installation of the sacred Fire” (most likely within this building) in

A.D. 1002 [Cœdès 1952:151]; and K.690, engraved on the south tower's door frame. In this second inscription, Cœdès "recognizes the end of an enumeration of lands among which the most important is the name of Vap Sikhavindu, author of a 921 inscription at Koh Ker" [1964b: 91]. The inscription consists of two distinct parts: the first concerns "it seems...a plan of foundations" in which Candrapura is mentioned, already indicated in K.691; the second "is a royal ordinance, possibly from Rajendravarman, asking two dignitaries to measure the capacity of the lands, or a land, of Vnam Kantal [Phnom Bakheng], most likely in order to give part of it to the god of Travan Rvau," the present Trapéang Ropou, whose name remarkably has been perpetuated. The text specifies that two people were in charge "of coming to check the exact dimensions of the land of Vnam Kantal." There follows an incomplete reference to a return of land "anew to the god of Travan Rvau." Despite the lacunae, it is clear that a dispute over the land's limits divided the sanctuary of Trapéang Ropou from the sanctuary of Phnom Bakheng. Unlike a number of inscriptions that evoke such land disputes sometimes very far away from the sanctuaries to which they belong, the sanctuaries' proximity here suggests that the lands were adjacent to each other (see map 4). If the enclosure CP807 existed at the time, we can only be surprised as it is not even mentioned in this delimitation. And this delimitation seems confusing enough to motivate the inspectors' visit. The bunded fields are still clear in that area; the ones associated with Prasat Trapéang Ropou, slightly oriented to northeast (78°), continues within CP807 (a on the map 4) until it meets with the bunded fields oriented around Phnom Bakheng: these two groups of fields were thus next to each other, and CP807 appears to be a later addition to Trapéang Ropou.

Prasat Kok Chak 420

The architectural remains—in particular the lintels—suggest that both towers of Prasat Kok Chak were built around the end of the tenth century, while the temple was a royal foundation. Most of the statuary discovered there, during an excavation in 1951, seems to date from that period and no modification has left any trace since. The inscriptions of this temple, K.521, were translated by Cœdès [1952:167-170]. They consist of two "independent texts [but] written by the same person and in close relation to one another. They must date from a little after Suryavarman I" (1002-1050) and the establishment of the sanctuaries. The inscription of the south tower relates the origin of this Sakabrahmana sanctuary's foundation, following a divinatory dream of Jayavarman III, who had lost an elephant in the forest covering his region at the time. After clearing the area, Visnugrama, the former name of Prasat Kok Chak, was consecrated. We will not treat the detail of the changing role

of this site and of its surrounding land, but only mention here that it was a royal foundation and domain until the reign of Suryavarman I, during which it was “offered to the Queen Viralaksmi [to whom] an ancestor of the inscription’s author mentions that the boundary stones had to be installed...The text gives the composition of the boundary commission and indicates the limits of the bounded lands.” Transcribed—but not translated—by Coëdès, the limits indicated at the end of the inscription mention, however, that one of the parcels of land runs, north, up to the lands of the Phnom Bakheng (I.12: Vnam Kantal).⁴² Even more clearly here than at Prasat Trapéang Ropou (its neighbor), the inscription shows that the Visnugrama’s *land* was adjacent to that of Vnam Kantal/Phnom Bakheng.⁴³ Here, once again, there is no mention of the city’s limits or of the dikes CP807: on the contrary, the delimitation of the adjoined lands requires a thirteen-person committee to install the wood and rock boundary markers. The epigraphy of Prasat Kok Chak also suggests that CP807 did not exist before the second half of the eleventh century and would not, therefore, constitute a vestige of a tenth century Goloupura.

A function for the southwest corner of Goloupura?

The morpho-chronologic assemblage, the observation of vestiges, the stratigraphic data, and the crosschecking of the ancient land-parceling groups with the epigraphic data stand in opposition to the reconstruction of Goloupura’s enclosure. However, the dikes of CP807 really exist and these embankments remain enigmatic, in function as well as in dating. We saw previously that a defensive explanation cannot be sustained even if we consider the scope of these works. Moreover, the Angkor region has no such feature whose defensive function can be certified, and we can only be circumspect about the real strategic potential of a single southwest corner. Focusing on the hydraulic aspect of the infrastructures, Groslier considered CP807 as an “artificial valley”: a forced circuit allowing at the same time the distribution of harnessed water, the cultivation of rice fields, and the seed or even having complementary cultivations” [1979: 183]. He mentions again that CP807 “can have been working only through the existing Western Baray. From then on, its function becomes clear: by the alternate game of the overflow of that *baray* and of the rise in the water level of the Siem Reap River (harnessed by the dike-dam to the southeast), it can be filled when needed, ensure seeding, irrigate the rice fields it holds.” If we can share this author’s observations concerning the water-supply sources for CP807, such a function seems however doubtful for a feature of such scope. It is indeed difficult to imagine that these dikes, reaching sometimes six meters in height, were built only to ensure a sheet of water for the first seeding, however crucial this may be. Besides, this function does not justify the very partic-

ular L-shaped layout of CP807. Finally, it ignores an essential characteristic of that “artificial valley”: the topographic documents indicate that the space between CP807’s two dikes is clearly below the surrounding formations, presently from one to two meters (see map 5 and fig. 1)⁴⁴ and probably slightly more during the Angkorian period. This suggests that the two dikes were built with the earth dug from the moat, and that this moat had permanent water all year round, as did Angkor Wat’s *moat*, for example, the level of which is quite similar. It is therefore inconceivable that this space could have served for the first rice seeding—not even for the cultivation of rice.

The present course of the Siem Reap River—the *stung* Siem Reap—seems in fact to have blurred the vision of the studied area’s function. Of course, Groslier assures having found traces of a seventh- to eighth-century riverbed to the east of Thommanon 380 [1979:165] and of a second “Bronze Age” one in Baskei Chamkrong’s surroundings 413 [RCA 1966], while a third may have been recently found around the Bayon [Gaucher 1996: pl. 3–8]. For the moment, these somewhat contradictory and diachronic indications suggest that for the moment the existence, the localization, and the regime of any former *stung* Siem Reap are not certain. In fact, Groslier’s maps [1979: map 2] themselves show the difficulty of reconstructing an “original” course.⁴⁵ Finally, remote sensing shows some “natural” traces meandering downstream, starting from the surroundings of Wat Athvéar, yet they are situated at the opening of some straight artificial sections.... Therefore, if we have to consider that a few courses of water could have existed before Yasovarman’s settlement in Phnom Bakheng’s surroundings, we can question the presence of a real, permanent river such as the present *stung* Siem Reap, the only traces of which are all artificial, north of the Eastern Baray as well as east of Angkor Thom, or even further south of the present city of Siem Reap. Jacques reports, “[Groslier] says apparently in jest: ‘Ultimately, I am not certain the *stung* Siem Reap existed’” [unpublished communication of Groslier, mentioned in Jacques 1978: 288]. By taking this witticism literally, while considering it only as a working hypothesis, several interpretation difficulties fade away while several other vestiges can be reorganized in a coherent way.

We can emphasize in particular the case of the important canal CP505 bordered by dikes that run, perfectly linear, from CP807 toward the south and the lake. The orientation of this canal, which, surprisingly, was not mentioned by Groslier,⁴⁶ connects the southwest corner of the moat of Angkor Wat to the western landing stage of Wat Athvéar, two foundations attributed to Suryavarman II. More precisely, the canal appears only south of the *exterior* dike of CP807, widely interrupted at that place. No trace of the canal appears on the surface of CP807’s “moat.” However, the

contour lines and the field surveys reveal a depression north of the *interior* dike, up to the corner of Angkor Wat's moat. Even if this depression does not seem to have exactly the same orientation, it is fully in CP505's prolongation. Besides, the breach in CP807's *interior* dike is particularly small compared to its southern counterpart.⁴⁷ Finally, our core-drillings (c10 to c16) indicate that the canal CP505 surely continues north of CP807: At its presumed location in the moat of CP807 (c11 and c13), the core sequence presents a very singular, thick deposit of sand, sometimes of a consequent granulometry that does not appear in the nearby cores elsewhere in the "moat" (c10 and c15).⁴⁸ It then appears that this CP505 canal was overlapped and probably interrupted by the CP807 embankments. Thus, CP807 is obviously a later addition.

Southwest of Siem Reap, the dike bordering the canal CP505's right bank disappears 1,400 meters after having intersected a canal connected to the Western Baray,⁴⁹ but the canal CP505 continues rather linearly, until it borders the west side of Wat Athvéar's "landing" pavilion. Farther south, it meets again with a canal/dike CP572 that reaches the eastern foot of the Phnom Krom, then the Tonlé Sap. If we consider the vestiges that orient or border this CP505 canal, it appears that it can be classified within the works of the first half of the twelfth century. Besides, its configuration presents, from the topographic point of view, a very obvious analogy with the CP574 canal connecting the Bakong to the lake. This latter canal constitutes, most likely, a channel used for navigation [Groslier 1998: 40; Pottier: 162].⁵⁰ It seems to me that one of the functions of the CP505 canal may have been similar, and thus connects the lake to the capital of the last half of the twelfth century.⁵¹ But other hydraulic functions can also be suggested, based on various analogies with another canal, CP570, running south-southwest from the Western Baray. This canal starts at the southwest corner of the canal grid associated with the *baray*, and leads directly to the lake, following the steepest slope. Remote sensing shows that this canal, besides being a likely drainage and overflow device, played a significant role in generating and expanding land development including cultivation fields [Pottier 2001: 111-112]. Present urban development of Siem Reap along the CP505 prevents us from conducting a similar analysis in that area and then clarifying the morphologic relationship between the canal and the adjacent lands. However, drainage and irrigation may also represent some conceivable functions for this CP505 canal, alternately with a circulation waterway. And, somehow, the *stung* Siem Reap had until recently quite similar uses: the early explorers landed in town after transferring in Phnom Krom from ships crossing the lake to smaller boats, passing through a rich cultivation strip along its banks supplied by a series of *noria*.

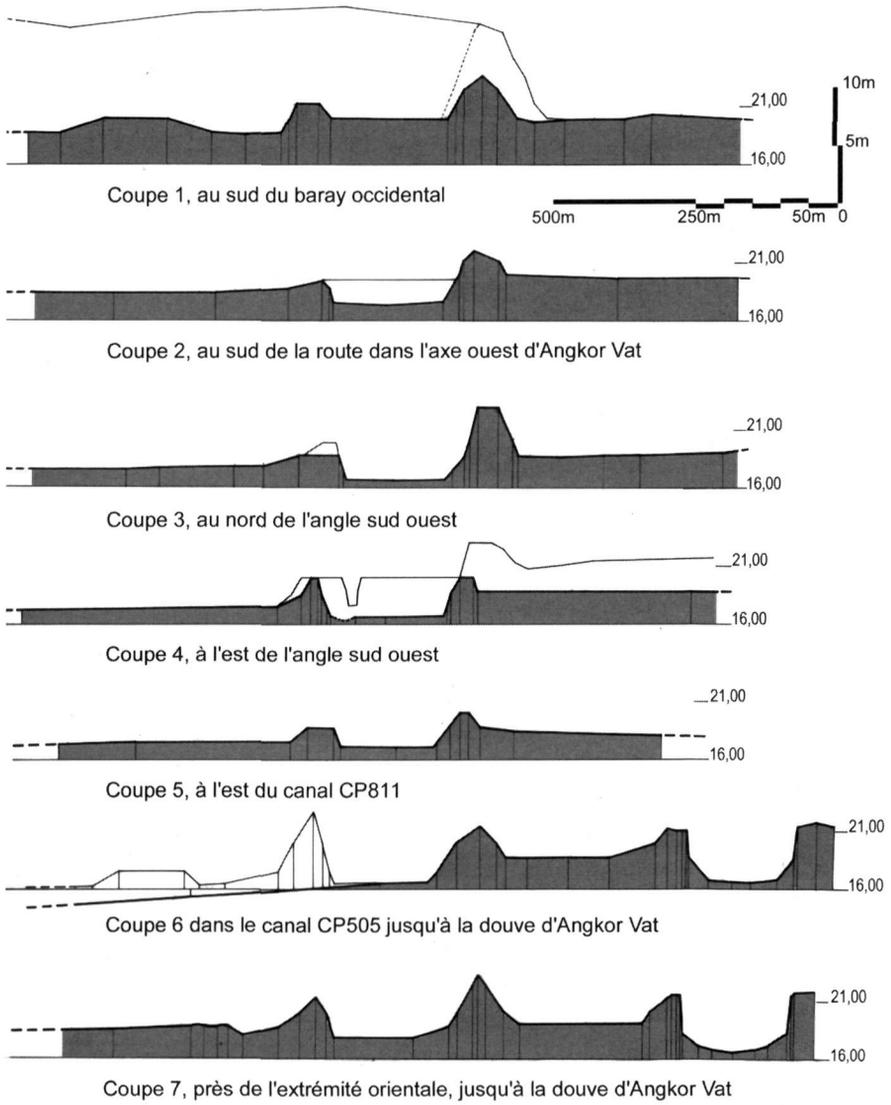


Fig. 1

Before getting back to CP807, let us point out that a second canal, of same kind, is located nearby to the east. It coincides with a section of the present-day course of the Siem Reap River, which runs from the southeastern surroundings of Angkor Wat toward the southwest in an oblique, and goes through the city of Siem Reap. Several elements suggest that this section of the river CP814, located in the prolongation of the canal dike CP572, which meets Phnom Krom, follows the course of a former canal established during the tenth century in order to connect the surroundings of the Eastern Baray to the Tonlé Sap [Pottier 1999: 168 n.514]. Finally, we can note that southeast of Angkor Wat, the dike CP806 zigzags as it crosses the CP814 canal. This particular configuration indicates that even if the river dates from later on, the canal CP814 is former to this CP806 dike. The same chronological relationship can be advanced between dikes CP806 and CP791, which connect the eastern surroundings of Phnom Bakheng to the Lolei *baray* at Roluos.

Considering the feature CP807 in its context and in a hydraulic perspective, we must notice, as did Groslier, that it is plugged west to the corner of the Western Baray and east to a corner formed by the dike coming south of Angkor Wat's southeast corner and the CP806 dike. If no connecting masonry work is presently visible at its extremities, the absence of such remains could not in itself and without further research contradict the probable existence of regulating devices of a former date. A similar remark can also be made regarding the eastern dike of CP807's southwest corner, which is interrupted by a wide eroded breach measuring twenty meters at its base.⁵² We could contemplate that CP807 was used to divert part of the *baray's* waters towards the dam constituting the CP806 dike, by blocking the course of the CP814 canal.

However, the levels within both dikes show that the lower section of the "moat" is not located at the eastern end of CP807 but between the CP807's southwest corner and the CP505 canal. Two slopes converge toward this canal: the first one from the Western Baray and the second from CP807's eastern extremity, reinforcing the close connection that seems to associate the CP807 feature with the CP505 canal.⁵³ We can emphasize finally that, despite the present state of alteration of CP807's dikes, the examination of their levellings suggest that they originally had the same altitude throughout all their length, the *interior* dike around 23 meters, the *exterior* about 21 meters. Considering a sheet of water at the altitude of 20 meters, the original capacity of CP807 can be estimated at more than 4.5 million cubic meters for a surface of 125 hectares.

Following this logic, CP807's double dikes would have constituted a derivation channel, perhaps even a storage device for a significant quantity of water from the Western Baray and, possibly, from the Eastern Baray or its surroundings via the

dam on the CP814 canal.⁵⁴ This function would be more in accordance with the CP807 dikes' capacity and would explain the layout and height of the dikes according to the topographic constraints of such a derivation partly uphill.⁵⁵ In support of this function, we can note that the only nearby feature we could compare to CP807 was interpreted by Trouvé as a supply channel.⁵⁶ The derivation of CP807 could thus have been intended to provide, at least temporarily, for the alimentation of the CP505 channel, which—as I mentioned above—could have been a waterway connecting the capital to the Tonlé Sap.⁵⁷ However, the difference in height between the dikes of CP807 and CP505 does not enable us to consider that vessels could have been harbored in the “moat.”

Finally, several elements suggest pushing a bit forward Groslier's later dating of CP807—to the Angkor Wat period [Groslier 1979: 183]. First of all, a slight but noticeable difference in orientation exists between the alignment of Angkor Wat and CP807's dikes (respectively 93° and 91°). Although we cannot grasp the reasons of such a difference, we can nonetheless see in it the indication that these two works are not contemporary. Besides, the CP505 canal, which I consider probably dating from the first half of the twelfth century, seems to have been interrupted by CP807, this last feature possibly having been built in order to make up for an insufficient level of water in the canal. From then on, CP807 appears to date from after the Angkor Wat period. Finally, the similarity of CP807 with the supply channel identified by Trouvé north of Angkor Thom also argued for a later date: This channel connecting with and opening onto Angkor Thom's moat at its northwest corner is, at the oldest, contemporary with Jayavarman VII's city. Thus it seems the CP807 feature may not date to before the end of the twelfth century. It is most likely a thirteenth century work, if not later. With this layout, if Angkor Thom *intra muros* was not directly accessible from the Tonlé Sap, the CP505 canal brought one within only three kilometers of it.

The extension of Yasodharapura I

Several types of arguments concur to deny Goloupura's existence, this vast enclosure delimiting Yasovarman's capital. Thus it seems we must abandon the idea of such an enclosed city. However, the heart of Yasodharapura I, as it was identified by Goloubew and developed by Groslier, seems incontestable: Phnom Bakheng, its axial causeways, and two concentric moats between which satellite sanctuaries are divided. Without going into detail about this relatively well known schema, but by abandoning Goloubew's hypothesis about the city's enclosure, we can from now on, and as a conclusion, wonder about the configuration, organization, and extension of this capital. Specific and in-depth research would be necessary to detail this ques-

tion; however, the field surveys and remote-sensing analysis offer some elements of response, or rather research directions.

We previously saw that Groslier emphasizes the connection between the development at the bottom of Phnom Bakheng and the Bakong's configuration [1979: 174-175]; this concerns, of course, the composition of the enclosures and the ring of satellite temples at the bottom of the *phnom*. But outside the temple's enclosures, the Bakheng, unlike the Bakong, generated a parcel grid that directly connected to the Eastern Baray, the Yasodharapura [Pottier 1999: 116-117]. We have emphasized that the south precinct of this *baray* shows a dense group of bunded fields, remarkably isoclinic with it and which expands westward until it includes Phnom Bakheng: this vast group of homogenous bunded fields is not perceptible in its entirety, but its coherence can be followed from the southern approach of the Yasodharatataka to Phnom Bakheng. If the main grid remains the same overall, two areas of bunded-field densification are perceptible: they are located at the approach of the Bakheng and of Pre Rup. As early as 1933, Marchal, observing the first set of vertical aerial photographs, had been "struck" by these very dense bunded fields at the approach of Phnom Bakheng and of Pre Rup, two sites which could each have been a capital's center; he notices a "mosaic of small rectangles more or less oriented and which represent rice fields" and considers that "the presence of these quadrilaterals, rice fields, or plantations, prove an inhabited part and can therefore reveal vestiges of a former city" [RCA 02/34]. This observation remains particularly relevant. The analysis of all the southern region of Angkor using recent aerial photographs confirms that such very dense field patterns, associated with a concentration of relatively small rectangular mounds of earth, are precisely to be found only in the direct proximity to Phnom Bakheng and Pre Rup.⁵⁸ They obviously delimit areas of over concentration around these major foundations. If this density of bunded fields and mounds are insufficient to reconstruct the details of the nature of ancient occupation without more precise investigations (in particular through archaeological excavations), they at least revealed a specific land use that strongly suggests the existence of the core of an "urban" settlement. These specific developments can then be considered as characteristic of these two Angkorian cities. Therefore, we can interpret the extension of the isoclinic bunded fields of less density as the evidence of a development directly connected to these capitals.

This particular bunded-field grid includes Phnom Bakheng and the developments at its base, the causeways and basins. In the regions free of canopy, the aerial photographs show that this bunded-field mass spreads, west and south, on a surface approximately orthogonal with limits distant of about 1,500 meters from the center of Phnom Bakheng (see light gray on map 4). This homogenous distribution

reflects, on a smaller scale, the geometric image of Goloupura, the existence of which I refuted earlier. But here no linear mark clearly delimits this banded-field group. Besides, this mass of fields also extends east, including for example Prasat Kravan, a foundation from the early tenth century. Thus this mass seems to be only a “zone of influence” generated from the Bakheng and a few associated structural features (in particular the Eastern Baray), rather than a land-parcel division established *inside* a possible strict delimitation. This field grid example shows, however, a relatively homogenous pattern, suggesting a globally geometrical plan based on central generating elements. But it is impossible to strictly distinguish the areas generated during Yasovarman’s reign from the ones by Rajendravarman some fifty years later when he established his “Yasodharapura I bis” south of the Western Baray, integrating his settlement inside the former pattern [Pottier 1999, 2003]. Besides, Goloubew’s experience showed us the fragility of reconstructing a general layout based only on a fragmentary preserved section. Here too, we can mainly discern the detail of the banded-field group in the southwest quarter, which included Yasovarman’s temple-mountain. It would therefore be reckless as well as vain to over-interpret it and to draw a general plan farther east without any additional data.

Yet this part of Yasodharapura I can be characterized by its open composition, centered on the Bakheng, structured by axial causeways and a land division with a homogenous orientation. Three schematically concentric rings can be distinguished: the religious complex in the center, a dense field grid associated with rectangular mounds and basins, surrounded by a loose extension of the banded fields, developing toward the southern side of the Yasodharatataka, where Yasovarman established the hermitages of four active religious sects under his reign [Pottier 2003].

Aside from the *geometrization* specific to the centrality of the “temple-mountain,” we can observe a spatial *hierarchy* visible from a morphological point of view of the banded-field pattern—unlike the former capital Hariharalaya. Besides, the rigor and extension of Yasodharapura I’s land division show an obvious intention to *control* the territory at the site of the new capital. The establishment of a homogenous field grid, generated by two major elements of the urban schema, the Bakheng and its *baray*, appears as a privileged way to remodel the landscape and therefore engage, outside the central temple’s walls, a real conformity of the territory in order to “order the universe.”⁵⁹ The rupture then appears even more clearly with the former capital if we consider that Yasodharapura I, relying on new hydraulic developments, leaves the naturally flooded banks of the Tonlé Sap for uphill lands. This *conquest* of the hinterland continued to the extreme with the temporary move of the capital to Koh Ker in 921 by Jayavarman IV.

The return of Rajendravarma to Angkor in the middle of the tenth century brings us back to one of the repercussions of the abandonment of the hypothesis of Goloupura. Hariharalaya, Yasodharapura I, and Chok Gargyar (Koh Ker) show a succession of *open* cities, without enclosure, underlining the fundamentally centrifugal character of these capitals and enabling us to reconsider—perhaps in a more flexible manner—their superpositions and displacements throughout the two centuries of occupation separating “Yasodharapura I bis” from the establishment of Angkor Thom under Jayavarman VII. In the case of Rajendravarma’s capital, for example, the analysis of the vestiges and remote sensing enables us to draw the first elements of an urban layout centered on Pre Rup [Pottier 1999: 176-199]. The open composition of this capital, baptized “city of the East” by Stern [1954: 678], is part of the tradition of former capitals and continues the developments of Angkorian urban planning. On the contrary, Angkor Thom, with its strong defensive enclosure and wide moat delimitation, does not appear to be a paragon of Angkorian urbanism anymore. It seems rather to constitute a clear rupture, which tolls the knell of the capital’s moves, and a kind of terminus by remaining in its enclosure for more than two centuries. Although it uses principles of former cities, it invents a new closed urban form, probably related to the dramatic discovery, in 1177, that Angkor was not invincible. Thus this period marks the introduction of massive defensive systems in the heart of the Khmer kingdom. But Angkor Thom also announces—at least formally—the beginning of dissociation between the city and its territory, two components that used to be closely related in a remarkable urban-rural continuum. The particularly numerous territorial developments under Jayavarman VII’s reign suggest, however, this separation must have been progressive. In that way, it is significant that, following two centuries of open urbanism, Jayavarman VII’s project would strive to establish in the center of the new enclosed capital a “temple-mountain,” the Bayon, which constitutes a real microcosm of the kingdom.

Notes

¹ This article is the translation, slightly modified, of the article “A la recherche de Goloupura” published in the *Bulletin de l’Ecole Française d’Extrême-Orient (BEFEO)* no. 87-1 (2000), p. 79-107. The text draws on the argumentation partially implemented in my doctoral thesis [Pottier 1999: 164-167], directed by B. Dagens at the University of Paris III-La Sorbonne Nouvelle. The argument relating to Golopura [1999, 164–167] has been, however, developed and completed, in particular by results of a recent series of experimental core-drillings carried out with R. Fletcher as part of the preliminary phase of the Greater Angkor Project, a joint project of the APSARA Authority, the EFEO, and the University of Sydney.

² The term “Goloupura” is found in Marchal’s excavation notes—for example: *Journaux de fouilles de la Conservation d’Angkor* (JF) 11: 179—in a context sometimes ironic but always friendly, which shows that Goloubew and Marchal were on good terms.

³ Groslier, however, seems to have been in complete agreement with *Goloupura* until the middle of the 1960s [Groslier 1961:100; 1965: 4]. His change of opinion could be related to the excavation he led in 1966 in the region of Baksei Chamkrong, see *Rapports de la conservation d’Angkor* [RCA 1966].

⁴ See for example: Glaize 1963: 95 (without modification in the last 1993 edition, annotated by Boisselier); Cœdès 1964a: 210; Boisselier 1966: 102-103; Jacques 1978: 290-292; and after 1979: Higham 1989: 326; Jacques 1990: 56-57; Ishizawa & Tamura 1999: 165.

⁵ Two inscriptions discovered before the 1930s (K.464 and K.558) identify the ancient name of the Bakheng temple: the Yasodharesvara [Cœdès 1911: 7; Finot 1925: 363-365; Jacques 1970: 57-67].

⁶ I inherited from my ZEMP consultancy—and perpetuated since—this prosaic numeration. The numerations used further in this article correspond to the ones I used to create a new cartography of Angkor’s south region [Pottier 1999].

⁷ Marchal agrees with the identification of the Vnam Kantal, but remains less convinced by the *existence of the supposed city’s enclosure*. As early as 1931, he writes: “I have mocked Stern too much about his deva-raja so confined to the miniscule chapel of the Phimânakas to be fully satisfied with the new location that Goloubew attributes to it.... I immediately came around to Goloubew’s thesis, for the abundance of these vestiges, all of the same style, is an important presumption of its exactitude: I precisely pointed out several times that the vestiges from Yasovarman’s time could be found almost all over except at the location of the city that was attributed to it. Goloubew’s thesis clears up this anomaly” [RCA 11/31]. On the contrary, we can sense in Marchal a certain skepticism concerning the paucity of the vestiges discovered, which Goloubew interprets as obvious proof of the existence of this city (for example: JF 9: 57 concerning the southwest corner of Goloupura CP784, or JF 9: 31 and 33 for the vestiges between the Bayon and the 486 Monument). His skepticism increases from October 1932 on, as Goloubew “indicates new vestiges, very vague, more than vague, but that [Goloubew] includes in Yasodharapura.... It is so vague that with some imagination, we can see anything!” [JF 9: 38-40]. The appellation of “Goloupura” thus seems evidence of Marchal’s doubts.

⁸ “Mr. Goloubew believes his work reveals the existence, inside Angkor Thom and within a short distance of the walls surrounding the capital, of a complete enclosure, unknown until then.... For considerations of a technical matter, Mr. Goloubew is inclined to attribute them to the first half of the eleventh century” [Trouvé, RCA 05/36]. See also Goloubew, 1936: 622-623; 1937: 651-652. However, this hypothesis seems to have been less accepted than Goloupura.

⁹ Goloubew 1933a: 325; 1934: 578. Aerial photography gained some followers, and Parmentier as well as Marchal or J.Lagisquet used it during the following years, but without systematically leading field campaigns to verify the located structures.

¹⁰ M. Périnelli, warrant officer of Hanoi’s Geographic Service, was put at the EFEO’s disposal in January 1934 in order to draw a map at 1/10 000 of Phnom Bakheng’s surroundings, which was finished in March (partially reproduced in Goloubew, 1934, fig. 17). At the end of 1936, the warrant officer Hodemon plots Angkor Thom at the 1/10 000 [Marchal 1937, pl. CX] and a car-

tography of the region surrounding Angkor at 1/40 000, while M. Gassier, inspector of civil engineering, established the leveling of many elements unearthed [Marchal 1937: 656-664].

¹¹ In 1966, Groslier began a program of restoration and highlighting of sanctuaries located at the bottom of the Phnom Bakheng “intended...to redefine the important and specific establishments of the City of the Bakheng” [RCA 1970]. When the sites were closed in 1972, the Prasat Bei, Thmar Bay Kaek, Bay Kaek, Sok Kro Op, and Rong Lmong had been restored.

¹² In 1932, Goloubew had a five-point program for his research: three points concerned—to different degrees—the presumed location of the city’s enclosure [1933a: 326]. “As characteristic elements of a city, I was only seeing a network of rectilinear avenues, with four main roads corresponding to the four cardinal orientations and starting from the bottom of the hill overlooked by the Devaraja’s temple” [1933a: 323].

¹³ The example of the Bakong cannot be accepted here: Goloupura constitutes an enclosure that does not exist in Bakong.

¹⁴ These observations stemming from the field surveys coincide with the recent topographic maps of the IGN and JICA. Since Buat and Ducret’s 1908 map, the configuration of that area has been subject to several diverging interpretations and cartographic errors. See for example: Parmentier, 1933: 1116.

¹⁵ This argument could be explained by the later heightening of the *baray*’s dike.

¹⁶ Groslier also underlined this chronology [1979: 183].

¹⁷ For example, on 1 November 1932, Marchal indicates in his journal, during research west of the Bayon: “How can I prove [to Goloubew] that a few bricks or pieces of laterite scattered on a vague tumulus were not—between the years 889 and 910—foundations of the king Yasovarman? I have no valid argument: the pottery or potsherds he found *proved* to him Yasovarman’s epoch, and he gathers them carefully. They are of the common kind I have come across since I have excavated Angkor Park or elsewhere!” [JF 10: 88].

¹⁸ We have mainly used here a stereoscopic set of 1/25 000 black-and-white vertical photographs, made by Finmap in February 1992, associated with previous aerial shots when needed: a similar set by IGN from 1953–1954 at 1/40 000, and partial set by Williams-Hunt from 1945–1946 at about 1/47 600.

¹⁹ The first topographic map at 1/10 000 was fulfilled at Groslier’s instigation at the beginning of the 1960s by the IGN and EFEO (published in Dumarçay and Pottier 1993, pl. 2-26). Recently, JICA made a topographic map at 1/5 000 and 1/10 000 [JICA 1998].

²⁰ Except for the area covered by Angkor Thom, we have covered most of Goloupura’s layout.

²¹ The diverse elements brought to light by Goloubew are plotted on the 1/10 000 1936 map [Marchal 1937, pl. CX]. Map 2 was made in 1963, probably under Groslier’s direction. He locates Goloubew’s search by indicating the year and sometimes the month of the work. This map is kept at the EFEO archives in Paris (no. 2750 CAP 42). Still, we must note that he does not list the vestiges that were plotted only on the surface.

²² About thirty meters for Angkor Thom’s causeway against more than a hundred for CP807’s *interior* dike (see below).

²³ Considering the cartographic collection available in 1932 and the virtuality of one of the two axes, we can doubt of the precision of the “exact” localization of that crossing.

²⁴ Moreover, Goloubew brought to the fore, the following year, a similar feature a few meters west [1934: 589-590 and fig. 13].

²⁵ This dike shows a width of about 30 meters at its base and is 175 meters away from Angkor Thom's axial causeway, dimensions that diverge completely from those of CP807's dikes (see below).

²⁶ The *baray's* dike shows a clean cut that seems to have been filled up at its center for the creation of the track on the dike's summit. Recent test pit excavations at the foot of the dike at this location unfortunately failed to prove the existence of a connection. (Greater Angkor Project, Preliminary Reports series (2) Phlao Neak Ta Dei Prambei Site: West Baray North-East Inlet June–July 2004).

²⁷ Marchal accompanied Goloubew once more on 4 October 1932 when he surveyed that area: he also noticed this dike's beginning "adhering to the *baray's* corner but immediately interrupted by rice fields" [JF 10: 11].

²⁸ Besides, maps enable us to see that the Bakeng's axis does not coincide exactly with the alignment of the *baray's* south bank, a detail that did not escape Marchal (see sketch JF 9: 62).

²⁹ "[At the] inside corner...slim brick fragments and at the bottom of the dike a few tiny sandstone blocks with no clear shape," "at the outside corner a [fragment of] a small round column similar to the one in Sambor..., brick and laterite fragments..., sculpted or cut sandstone blocs but too buried to identify..., a sculpted piece embedded in a tree's roots (antefix stone or pilaster motif of Indravarman's art)," "further north...a small standing female statue" [Marchal JF 9, 56-57].

³⁰ Revealed only north of the corner of the "exterior earth embankment...a small summit of a triangular pediment with a classic ornamental motif, [and] a flat antefix decorated with a *dvarapala* in the pose of the ones of Lolei." Marchal also notes, "coming back [on the *interior* dike] the existence of 2 Neak Ta [at Sre Daun Sâr].... These stones...probably come from some classic *prasat*." He also wonders: "Maybe is it the same about the sculpted stones near the dike's corner?" [JF 9: 86-87].

³¹ A few vestiges found ("the flat antefix") can certainly come, in part, from the Bakheng's period. But Marchal notes that these vestiges remain particularly small to suggest the existence of a sanctuary of Yasovarman and to date the dikes, because no structures have been found. As for the small column that "would be like the one of Sambor," the sketch of it [JF 9: 57] could as well be showing a baluster of a high bay (library, or long room from the end of the tenth century on?). On the other hand, elements (the "antefix stone or pilaster motif of Indravarman's art," the "summit of a triangular pediment," a long molded block of sandstone that seems to have had roof spikes because the top shows traces of mortise) could indicate not only a later period but also that the structures these elements came from could have been destroyed during the creation of these embankments. They would therefore be at least from the classical period, "post-Indravarman."

³² Of course the fact that part of the eastern "exterior dike" was profoundly altered during the building of the airport next to it in the years 1945–1946 was here taken into account (see map 5 and fig. 1, coupe 2).

³³ This site CP654 presently shows nine rectangular mounds (50 by 40-30 meters) covered by scrub that towers above the surrounding rice fields. The mounds are aligned along three east-

west "lines" about twenty meters apart and three north-south "columns" about thirty meters apart. The existence of a fourth "line" north is suggested by the aerial shots. Although not very noticeable on the ground because of a continuous "impenetrable" scrub front, these northern mounds seem to be part of an original configuration, for the aerial photographs show the almost square trace (270 by 290 meters) of a depression (moat? in rice fields presently) that surrounds all of the mounds (four lines and three columns).

³⁴ In 1931, during the preliminary clearing for the creation of a trail in the major axis of Angkor Wat leading to the airfield, Marchal notes "the discovery of an embankment, perpendicular to the temple and that must have been a former Khmer causeway, about 300 meters away from the moat [of Angkor Wat]. It would be good to follow this causeway, which is not reported on any map, to know where it leads" [RCA 08/31]. The field surveys he led the following year with Goloubew did not bring any new element to light.

³⁵ It is the remains of a brick sanctuary, with a sandstone frame and pedestal and laterite foundations, established on a high mound. It has octagonal uncarved columns, but none of the elements seemed to me to enable a precise dating. That this sanctuary is contemporary with or posterior to Yasovarman, its location tends to contradict the existence of Goloupura's southeast corner. Indeed, if the incompatibility is obvious if it dates from the beginning of the tenth century; it is also hard to imagine that a sanctuary would have been built later on, "astride" the moat and Goloupura's *exterior* dike, whether it was before or after they had been leveled.

³⁶ Kapilapura was "discovered" and excavated in 1924 by Marchal and likely dates to the tenth century. In June 1924, it was Goloubew who was put in charge of doing the rubbing of K.579 with the date of A.D. 968 [RCA 06/24].

³⁷ This quite irregular embankment is about one hundred meters wide. On the south side of Angkor Wat, it seems to be noticeably narrower, only fifty meters. Besides, the aerial photographs and the topographic maps show that the shape of the dike's elevation on Angkor Wat's eastern side differs and is not aligned with the dike, which continues south and meets the eastern end of CP807.

³⁸ Although in 1933 no continuity of the causeway on the left bank is indicated [1933a, fig. 55], it is suggested on Trouvé's 1934 map [Dumarçay and Pottier 1993: pl.1].

³⁹ At the beginning of 2000, the JSA team (Japanese Government Team for Safeguarding Angkor) excavated a north-south trench at the Bayon, from the first enclosure to the present road around the temple. About eighty meters in length, this remarkable section was established between pits 3 and 8 of Dumarçay and shows a similar stratigraphy. No trace of a possible moat is visible.

⁴⁰ This series of experimental core-drillings was financed by the EFEO and the Australian Research Council.

⁴¹ We note in particular the insertion of all of structures at the foot of the *phnom* in this banded field.

⁴² This reading was kindly confirmed to us by Claude Jacques.

⁴³ If the text of the inscription seems more clear, the analysis of the ancient banded field is less so; the south limit of the isoclinic group at the Bakheng is clear south of the present causeway west of Angkor Wat, but we do not observe any obvious trace of the Prasat Kok Chak's banded fields continuing north of CP807.

⁴⁴ The leveled points of the topographic maps of 1962 [Dumarçay and Pottier 1993: pl. 9] are less numerous inside CP807's "moat" and do not bring this characteristic to the fore. In particular, the spot height of 18.3 meters, indicated at the center of the moat's southwest corner, seems unrepresentative of the level of the moat's bottom at that location; it is at best the top of a small mound where a few sugar palm trees now grow and that was probably used as a benchmark during the elaboration of the altimetric data. This point is designated on the original leveling layer (no. 2690, archives EFEO Paris) under the code "cr" meaning "cote restituée," thus not determined on the field [F. Boldo, IGN engineer, personal communication]. The new topographic map done by JICA is, for that area, more precise [JICA, 1998: pl. 5 and 9 at 1/5 000 and pl. 6 at 1/10 000]. We have completed these levels with a few points directly surveyed in situ; they are in italics on map 5.

⁴⁵ We note certain ambiguities as some of the proposed courses follow the outline of works obviously *from a later time* (such as the northwest corner of the Eastern Baray) and come from a derivation that could date from Rajandravarman.

⁴⁶ The canal CP505 is not mentioned in the text of the "Cité hydraulique." It appears only on the maps attached to the article, where it is considered one of the presumed courses of the *stung* (river) Siem Reap.

⁴⁷ The section of Commaille road is established on the western bank of the depression and then crosses it north of CP807 before cutting the *interior* dike.

⁴⁸ The connection of the CP505 canal to Angkor Wat, however, is not obvious in the core-drilling c12. The detail of that connection goes beyond the present study.

⁴⁹ This CP504 canal begins on a network of CP483 canals located near the southwest corner of the Western Baray and several elements suggest these hydraulic works are contemporary with *this baray* [Pottier 1999: 119-123; 2001].

⁵⁰ In August 1932, Goloubew plotted the mouth of the CP574 canal and considered it as the "landing stage of the former city of Hariharalaya" [JF 9: 272]. Groslier has also connected this feature to the canal, called "of Damdek," located about thirty kilometers east of Angkor, suspected since the beginning of the twentieth century to have supplied a privileged waterway for the transport of sandstone blocks from the Kulen quarries.

⁵¹ Such a function for this type of work conflicts with the skepticism of hydraulic engineers who rather see drainage devices in them. This function, which I willingly recognize, does not exclude a priori the first, for the former hydraulic regime remains unknown, which makes all comparisons with present conditions awkward.

⁵² This breach is not indicated on the topographic maps of 1962 [Dumarçay and Pottier 1993: pl. 9], but it is reported on those of 1998 [JICA 1998: pl. 9 at 1/5,000 and pl.6 at 1/10,000]. It is perfectly visible in the field; the undergrowth that covers the area keeps us from noting specific vestiges.

⁵³ A distressing story recently confirmed that the lowest point of the moat corresponds to the CP505 canal. In 1996, three military officers living just east of the Prasat Prei (CP447) had a deep and wide basin dug, embellished with flowers and a bungalow (and sold the embankment obtained). To fill it with water, they created a trench connecting it to the CP505 canal passing close by to the west, and stopped the canal with a two-meter-high dike. It was rather effective in filling their basin. But as soon as the first rain fell, all of the "artificial valley's" rice fields

were flooded up to the causeway located in Angkor Wat's western axis. All of the rice beds were lost. Protected by a tank and an armed watch, this dike was the object of an iniquitous dispute, which lasted two years during which no rice fields could be cultivated uphill. A pipe was finally installed under the dike, the "charming" basin is now dry and the rice field cultivated again. Yet this sad anecdote shows that a simple two-meter-high dike located on the CP505 canal, four hundred meters downstream from the breach in the *exterior* dike of CP807 can flood the major part of the "artificial valley," supplied only with rainfall.

⁵⁴ If this corner was able to store the water coming from the Eastern Baray's surroundings, if not from the *baray* itself, the approach to the unnamed sanctuary CP870 must have been flooded. The sanctuary itself may not have been able to stay above water. We can notice that it is built on a much higher mound, about four meters, than other similar sanctuaries.

⁵⁵ We have previously indicated the existence of the Kok Daun Bos CP654 at the southwest *exterior* corner of CP807, near the lowest point of the interior lands, at a place of a possible outlet. In fact, a canal presently crosses the *exterior* dike, but no element shows that this cut was original.

⁵⁶ This work discovered by Trouvé [1993, 1124, fig. 54 and 55] is constituted by two 4- to 6-meter-high dikes surrounding a 100-meter-wide space. It shows an L-shaped route, forming an angle northwest and connecting to the northwest corner of Angkor Thom's moat (see map 5). We also notice the existence of a partly similar work CP737: it is located at Roluoc and forms a U, including the west and south sides of Prei Monti 474, continues east and runs back straight north to connect with the southeast corner of Bakong's exterior moat. It seems possible that it is connected to the canal CP574 that meets the lake, offering a tempting similarity with CP807.

⁵⁷ It is not known whether the canal was supplied during the entire low-water period, for we do not yet have precise data on pluvial and hydraulic regimes of that time. The CP505 channel could have also been supplied by a narrow canal bordered by two dikes that, two hundred meters south of the *exterior* dike of CP807, come from the east and the corner constituted by the embankment continuing Angkor Wat's east side and by the CP806 dike. This canal continues (without its lateral dikes) west of CP505 and meets with a CP811 canal coming from Angkor Thom's south moat, near its southwest corner. This last canal is obviously a construction dating from after the CP807 dikes.

⁵⁸ It is however important to note that the surroundings of the later pyramid temples, for the most part, show a density of vegetation that prevents our plotting the ancient field patterns.

⁵⁹ Concerning the "ordering of the universe" through architecture, see Dumarçay, 1998: 79-86. The development of the territory expressed itself at the time also by the multiplication of important private foundations established around wide *trapéang* in the Angkorian periphery, establishments specific to the *phnom* in the area or even the appearance of causeways, connecting remote points of the territory, even of the kingdom [Pottier 1999: 169-175].

Hydrology and the Siting of Yasodharapura

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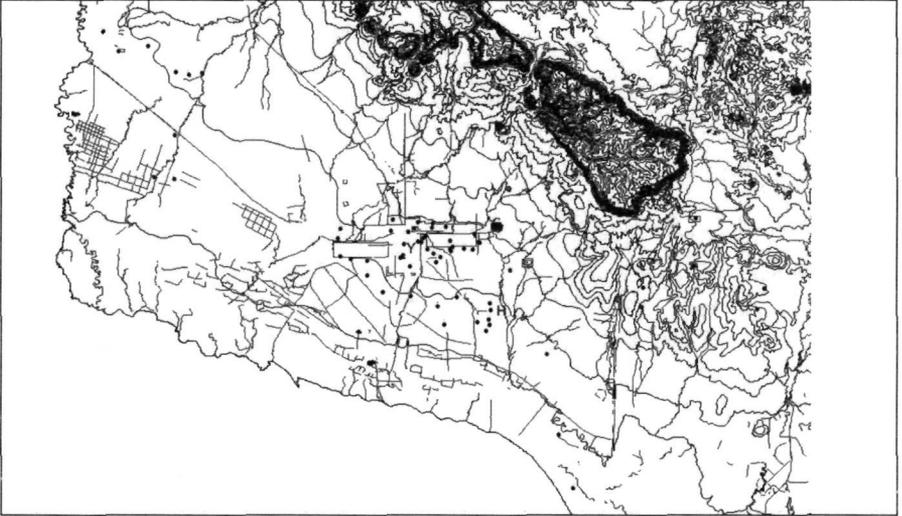
The theoretical setting

The kingdom founded on the north Cambodian plain was the first, largest, and richest empire in medieval mainland Southeast Asia. Founded early in the ninth century, it ruled an area that within two hundred years comprised most of modern Cambodia, southern Laos, and northeastern and central Thailand; in the twelfth century, it created one of the wonders of the world, the monumental temple complex of Angkor Wat. The fundamental question in Khmer studies is the determination of the factors that enabled medieval Cambodia to become so large and so rich so early.

The first comprehensive theory, that of Bernard-Philippe Groslier of the *Ecole française d'Extrême-Orient* (EFEO), claimed that medieval Cambodia grew powerful through intensive rice irrigation from massive, rectilinear water-holding devices known as *baray*, which permitted rice crops to be grown in the dry season as well as the wet. *Baray*-based irrigation fed the army that supported the empire and the workforce that built its temples. In the second half of the ninth century, the first *baray*, the Indratataka, was built just north of the first capital, Hariharalaya, on the north shore of the Great Lake (Tonlé Sap). The Indratataka measured about 3 kilometers along its east-west axis and 750 meters along its north-south axis; given a water depth of 3 meters, it could have held almost 7 million cubic meters of water. Toward the end of the ninth century, the capital moved from Hariharalaya to a new site on the banks of the Siem Reap River, about 18 kilometers northwest of Hariharalaya and 12 kilometers north of the shore of the Great Lake. The new capital, Yasodharapura, was built around an elevation, Phnom Bakheng, on which the state temple was constructed. A new and much larger *baray*, the Yasodharatataka or Eastern Baray, was built at around the same time, just to the east of the new capital. It measured 7.5 kilometers along its east-west axis and 1.8 kilometers along its north-south axis; with a depth of 3 meters, it could have held 40 million cubic meters of water. About 150 years later, in the middle of the eleventh century, the largest *baray* of all, the Western Baray, was built just west of the capital district. With an east-west axis extending for 8 kilometers, a north-south axis 2 kilometers in length, and a probable water depth of 5 meters, the Western Baray was capable of holding around 80 million cubic meters of water.¹

Map 1, derived from data prepared by the Japanese International Cooperation Agency, depicts most of the southern Siem Reap province. The location of the first capital at Hariharalaya is indicated by the capital letter *H*, and the capital letter *Y* shows the location of Yasodharapura. The ninth-century Eastern

Baray and the eleventh-century Western Baray are indicated by the two large rectangles to the east and west of Yasodharapura. The Phnom Kulen range appears in the map's northeastern corner, and a small portion of the Great Lake appears in the southwest.



Map 1

In short, the medieval Cambodian capitals were associated with mammoth *barays* from their very beginnings. For several decades beginning around 1960, the dominant explanation for Angkor's early rise was that its power and prosperity were based on irrigated rice culture made possible by the *barays*. This was the so-called hydraulic thesis, chiefly promulgated by Groslier of the EFEO. Groslier hypothesized that water retained in the *baray* enabled a dry-season rice crop to be grown on the land downslope from the *baray* and also permitted a full wet-season crop to be grown even during years of abnormally scanty rainfall, in turn supporting Angkor's army and its urban workforce. In short, the hydraulic thesis, going far beyond agronomy, attributed every aspect of Angkorian society—its economic base, labor organization, supposedly centralized politics, in fact its entire historical trajectory—to *baray* irrigation [Groslier 1966, 1979].

The hydraulic thesis, however, was never quantified or tested. Beginning in 1980, criticisms began to accumulate. The hydrologist van Liere published two papers, whose main thrust was that Khmer engineering could not provide the outtake structures needed to distribute water from the *baray*, and that in point of fact no trace of distributary canals could be found downslope from the *baray* [van Liere

1980, 1982]. In 1992, Stott restated van Liere's critique and added criticisms of his own, first that there are no textual references in the very extensive Angkorian corpus to any irrigation works of any kind, and second that the labor force that built the *barays* must have preexisted them and so could not have owed its sustenance to rice grown by *baray* irrigation [Stott 1992]. Several years ago, I undertook quantitative tests of the hydraulic thesis that indicated that the *barays* could not have irrigated more than a small fraction of the land downslope from the *barays* but above the north shore of the Great Lake, and that the rice that could have been grown on the land thus irrigated could have fed only a minuscule fraction of the population of medieval Cambodia. Thus *baray* irrigation, even if it existed, cannot have been responsible for the greatness of the Angkorian empire. I suggested that the *barays* were part of the urban architecture of Angkor, and that Angkorian agriculture may have been based on another unique aspect of Angkor's geography, the very high water table underlying most of the north shore of the Great Lake.

Recent research

Christophe Pottier of the EFEO, in the course of an extensive exploration of the area downslope from the *barays*, has discovered a network of canals near the southwest corner of the Western Baray [Pottier 2001]. While these canals suggest the existence of some sort of hydraulic system related to the Baray, they nonetheless surround no more than 600 hectares, an area utterly insufficient to have supported medieval Cambodia's labor force or to have played a decisive role in its economy. Remote sensing techniques used by Roland Fletcher of the University of Sydney have revealed canals to the north of the capital district [Fletcher 2000, Personal communication: meeting in Berkeley, California], but these very long canals, which have few distributaries, apparently served to connect the capital district with the northwestern spur of the Phnom Kulen range of hills, and so may well have been built for purposes of transportation rather than irrigation. In sum, these discoveries point to an extensive and well-engineered water system for the capital district but, if anything, seem to argue against the hypothesis that irrigation was the main purpose of the water retention devices or that these devices played a decisive agronomic or economic role.

Another recent discovery, having to do with the specific siting of the capital district, may contain a clue that bears on the basis of medieval Cambodia's agricultural wealth. It was originally believed that the Khmer moved their capital from Hariharalaya, located near the small Roluos River, to Yasodharapura to take advantage of the larger Siem Reap River at the new site, but this belief has been recently disproved. Excavations carried out by Pottier have demonstrated that the Siem

Reap River is not a natural river but a diversion from the Puok River at a point around 15 kilometers north-northeast of the capital district. Further work by the hydrologist Terry Lustig of the Greater Angkor Project has shown that the diversionary works were built at the end of the ninth century, at about the same time that the capital moved from Hariharalaya to Yasodharapura. But if the Siem Reap River is a diversion created at the same time as the new capital was built, it follows that the capital cannot have been relocated to take advantage of the river. To the contrary, the capital was moved from a riverside location to one of the few places on the north Cambodian plain that had no river, and a river was then brought to it. Thus it must have been some other factor that made the new location attractive, so attractive that even the mammoth job of diverting a river to that location was justified. The present paper proposes and tests the hypothesis that the decisive factor in the relocation of the capital was the high water table around the new site: the new capital was relocated to that part of the north Cambodian plain where groundwater resources were closest to the surface, and these water resources were the basis of medieval Cambodia's prosperity and greatness.

The high water table hypothesis

Basic hydrology

The high water table beneath the north Cambodian plain is caused by the plain's geology and its climate. A substrate of ancient and largely impermeable sandstone is overlaid by a relatively thin layer of highly permeable Quaternary sedimentation; meanwhile, the region's average annual rainfall is about 1,400 millimeters [Rasmussen and Bradford 1973]. Rainwater infiltrates the very permeable alluvium quite easily but cannot infiltrate farther because of the impermeable sandstone just beneath it, so that groundwater, supported by the sandstone layer, is found close to the surface of the plain.

Contemporary Cambodian farmers make good use of the high water table to supplement rainfall for their rice crops during the rainy season and to water their domestic animals during the dry season, which extends from November through May. Small tanks—artificial ponds dug into the water table—are found next to almost every house in rural Cambodia [Garami and Kertai 1993], and farm villages are sited next to somewhat larger tanks [van Liere 1982]. The historical record shows that this is no recent practice. Chinese travelers of the fifth century noted the presence of village tanks [Pelliot 1903], and Cambodian rural settlements of the eighth century were similarly located around natural and artificial ponds [Vickery 1986].

The combined water-holding capacity of large numbers of small- and medium-sized tanks is enormous. According to Stargardt [1983], who studied the ancient

agronomy of Satingpra, an area on the Tenasserim peninsula with a water table similar to that of Cambodia, the average village tank contained 6,000 cubic meters of water during the wet season and 3,000 cubic meters during the dry season. These figures may seem insignificant compared with the very large *barays* around Angkor, whose capacity was measured in tens of millions of cubic meters. But while the large *barays* were built by embankments resting on the land surface, tanks are dug into the water table and so refill automatically. Thus their annual capacity is much greater than their volume; an estimate of 500,000 cubic meters per year per tank is not implausible. If there were 800 such tanks in the vicinity of the capital district, to adopt a figure found in Higham [1989], the tanks in the capital district had a combined annual capacity of 400 million cubic meters, much greater than the capacity of all the great *barays* combined.

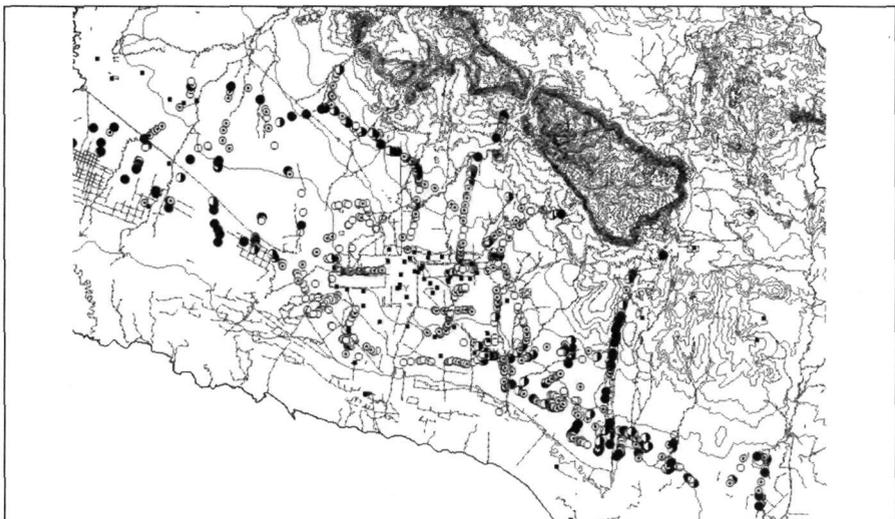
Prior research on Cambodia's groundwater resource

Some early research on groundwater resources in Cambodia demonstrates a correlation between high water tables and the locations of Khmer settlements dating from the earliest times. In 1961, Rasmussen collected data on the level of the water table in much of Cambodia, based on measurements of the water levels in tube wells, ordinary wells about a meter in diameter, bored into the earth and usually lined with concrete. Rasmussen's data demonstrate two things relevant to this inquiry. First, nearly all of central Cambodia has a high water table, with water almost always found within 5 or 6 meters of the surface. Second, four Cambodian provinces, Kompong Thom, Siem Reap, Svey Rieng, and Takeo, have even higher water tables, with water found 1, 2, or 3 meters below ground. Takeo is the home of Angkor Borei, the earliest seat of Khmer civilization; Kompong Thom is the home of Sambor Prei Kuk, the capital of the Khmer kingdom in the seventh century, and Siem Reap is the home of the successive Khmer capitals between 802 and 1431, Hariharalaya, Yasodharapura, and Angkor. Only Svey Rieng, located in the borderland between the Khmer and Cham kingdoms, was not the home of an early Khmer capital. While Rasmussen's data thus contain clues to the importance of high water tables in forming Khmer settlement patterns, his data are not detailed.² The number of data points in each province varies from less than a dozen to a few dozen; the data points are apparently closely grouped within most provinces rather than distributed across the provinces, and specific locations of the data points are not provided. Before reliable conclusions can be drawn correlating the height of the water table and the location of Angkorian settlement centers, greater quantities of more widely distributed and specifically located data points, with precise information concerning water levels, are necessary.

Hypothesis testing

Data collection

Consequently, between January and March 2005, I measured the subsurface water levels in 830 tube wells around Siem Reap province. Although I measured water table levels in the middle of the dry season, the important consideration was how the water table affected rice farming during the rainy season. To determine this, I interviewed farmers, virtually all of whom reported that the water level in their wells rises by 2 meters between the middle of the dry season and the end of the rainy season. These reports were verified by checking the water marks on the inside of the wells.



Map 2

The data I collected are displayed on map 2, on which the locations and water table levels of the measured wells are depicted. The levels are classified as “very high,” “high,” “mid-level” or “low.” These are classified as follows:

- ♦ Very high water tables (open dots) are those within 1.5 meters of the surface when measured halfway through the dry season. With the typical 2-meter rise by the end of the rainy season, the water here will rise to the surface halfway through the rainy season and inundate the land.
- ♦ High water tables (dots with centerpoints) are those more than 1.5 but less than 2.5 meters below the surface when measured halfway through the dry season. With the typical 2-meter rise by the end of the rainy season, the water here will nearly or fully inundate the land by the end of the rainy season.

♦ Mid-level water tables (hemispheres) are those more than 2.5 and less than 3.5 meters below the surface when measured halfway through the rainy season. By the end of the rainy season, the water here will be approximately a meter beneath the surface.

♦ Low water tables (solid dots) are those more than 3.5 meters below the surface when measured halfway through the dry season. Water here will remain well below the surface throughout the rainy season.³

The data contained on map 2 are also presented in tabular form. Table 1 shows the measured water table levels within a 7-kilometer radius of the Bakong temple at the center of Hariharalaya; table 2 shows the measured water table levels within a 15-kilometer radius of the Phnom Bakheng temple-mountain at the center of Yasodharapura; table 3 shows the measured water table levels in the eastern part of Siem Reap province, east of the Roluos River; and table 4 shows the measured water table levels in the western part of Siem Reap province, more than 15 kilometers west of Phnom Bakheng.

Table 1 - Measured water table levels within 7-kilometer radius of the Bakong; n=72

| Water table level | Number of data points | Percentage of total |
|-------------------|-----------------------|---------------------|
| Very high | 14 | 19.4 |
| High | 42 | 58.3 |
| Mid-level | 14 | 19.4 |
| Low | 2 | 2.8 |

Table 2 - Measured water table levels within 15-kilometer radius of Phnom Bakheng; n=250

| Water table level | Number of data points | Percentage of total |
|-------------------|-----------------------|---------------------|
| Very high | 118 | 47.2 |
| High | 119 | 47.6 |
| Mid-level | 13 | 5.2 |
| Low | 0 | 0.0 |

Table 3 - Measured water table levels in eastern Siem Reap province; n=250

| Water table level | Number of data points | Percentage of total |
|-------------------|-----------------------|---------------------|
| Very high | 25 | 10.0 |
| High | 101 | 40.4 |
| Mid-level | 62 | 24.8 |
| Low | 62 | 24.8 |

Table 4 - Measured water table levels in western Siem Reap province; n=112

| Water table level | Number of data points | Percentage of total |
|-------------------|-----------------------|---------------------|
| Very high | 16 | 14.3 |
| High | 40 | 35.7 |
| Mid-level | 24 | 28.6 |
| Low | 32 | 21.4 |

Groundwater resources and settlement locations

A comparison between the groundwater resources around Hariharalaya, the first capital, and those around the new capital at Yasodharapura shows that

- The water table is on average significantly higher around Yasodharapura than around Hariharalaya. There are 72 data points located within 7 kilometers of the Bakong, the temple at the center of Hariharalaya, of which 42, or 58.3%, are high, 14, or 19.4%, are very high, a further 14 or 19.4% are midlevel, and the remaining two, comprising 2.9% of the total, are low.⁴ Across this area, approximately 154 square kilometers in extent, the average depth of the water table is slightly greater than 2 meters below the ground surface halfway through the dry season, so that this area, on average, would not be inundated during the average rainy season.⁵

By way of contrast, the new capital of Yasodharapura was situated in the very center of an almost perfect circle, approximately 30 kilometers in diameter,⁶ within which groundwater resources are very close to the surface. Of the 250 data points within this 30-kilometer circle, 118 are very high, 119 are high, and 13 are mid-level; none are low. The average depth of the water table within this area is slightly greater than 1.5 meters below the ground surface in the middle of the dry season, so that virtually the entire region would have been inundated during the rainy season.⁷

- There is less variation in water table levels around Yasodharapura than around Hariharalaya. As noted, water table levels around Hariharalaya varied widely, with as many mid-level data points as very high points. By way of contrast, almost all the data points around Yasodharapura were high or very high, and the high and very high points were practically equal in number. In short, the average variance from the mean water table depth was twice as great around Hariharalaya as around Yasodharapura.

- The region of high and very high water tables around Yasodharapura was much larger, more precisely almost four times larger, than the corresponding region around Hariharalaya. The area of the 30-kilometer circle of high and very high subsurface water around Yasodharapura measures approximately 700 square kilometers, over four times larger than region within 7 kilometers of Hariharalaya, with its mixture of mid-level, high, and very high data points, and around thirty times larger than the high and very high water table within 3 kilometers of Hariharalaya.

A comparison between the area around Yasodharapura and the far eastern and far western parts of Siem Reap province, where no capital was ever sited, shows much starker contrasts in water table levels:

- The eastern part of the province has a much lower water table than the regions around either Yasodharapura or Hariharalaya. Specifically, while only 5.2% of the data points around Yasodharapura, and 22.3% of the data points around

Hariharalaya, reflect a mid-level or low-level water table, 49.6% of the data points east of the Roluos River were mid- or low-level. Moreover, the concentration of low and mid-level data points increases the farther east one proceeds. Between the east bank of the Roluos river and the road connecting Beng Mealea with the shore of the Great Lake, 53% of the data points (73 of 138) are very high or high; but between the Beng Mealea road and the eastern border of Siem Reap province, 53% of the data points (59 of 112) are mid-level or low.

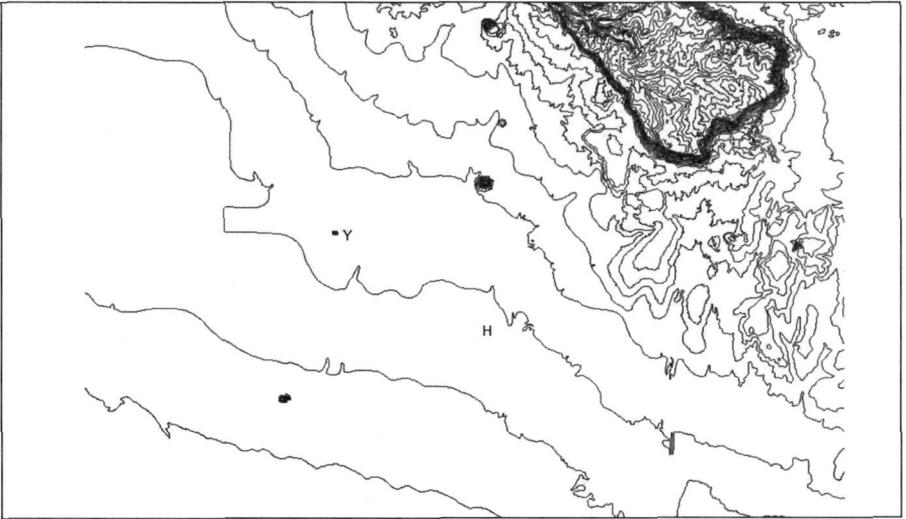
- The water table in the western part of Siem Reap province is also much lower than the water table around the capital district, with especially low water tables found in the area closest to the Great Lake. In all, 50% (56 of 112) of the data points in the area between the 30 kilometer circle around Yasodharapura and the western boundary of the province show a mid-level or low-level water table. In the area between National Route 6 and the Great Lake, 34 of 48 data points, or 70.8%, are mid-level or low. Meanwhile, there are 64 data points in western Siem Reap province to the north of NR 6, of which 22, or 34.3%, show a mid- or low-level water table.
- Moreover, while there are regions with very high water tables in the western part of the province, practically all of them are found in two clusters. One of these is just northwest of the Western Baray and so is on the verge of the capital district, while the other, in the far western part of the province, is very suggestively located around a cluster of Angkorian sites,⁸ and so was apparently a secondary settlement cluster to the west of Angkor.

Summary

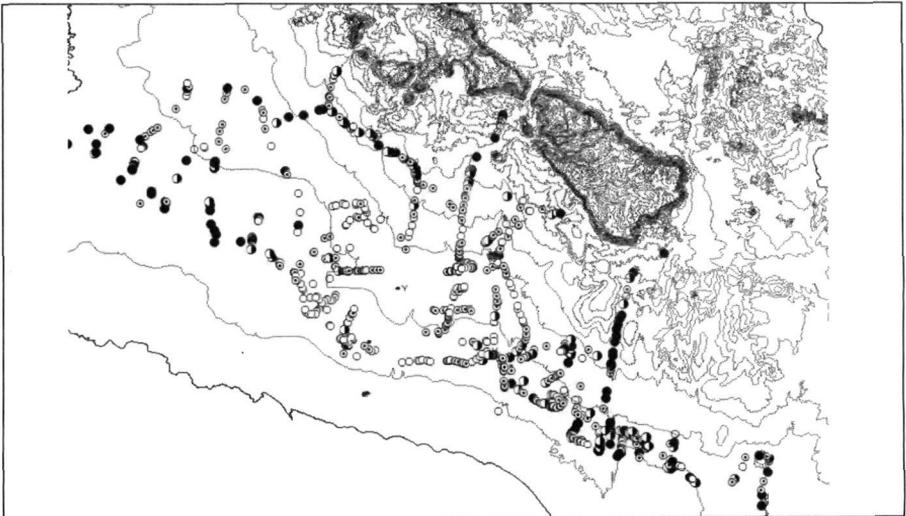
The data presented here strongly confirm the hypothesis that Angkorian capitals were sited where high subsurface water levels could be found in the surrounding terrain. The water table around Hariharalaya is significantly higher than the water table found further to the east in areas closer to the older Khmer centers. The new capital district at Yasodharapura was placed in a large region of very high subsurface water, which far surpassed the region around Hariharalaya in size, consistency, and, most important, subsurface water proximity. More striking still, Yasodharapura was placed in virtually the exact center of that region. Finally, what may be the largest cluster of Angkorian sites outside the capital district is found in the middle of the only region outside the district with very high subsurface water levels.

The relationship between the locations of Hariharalaya and Yasodharapura and the height of the water table is graphically illustrated on maps A and B, which are simplified versions of maps 1 and 2, respectively. Map A depicts the locations of Hariharalaya (H) and Yasodharapura (Y) and the topological features in central Siem Reap province; Phnom Bakheng can be seen just west of the Y marker. Map B

is map A with the water-table data added. It will immediately be seen that Hariharalaya is on the periphery of the large, nearly circular zone within which the water table is almost entirely high or very high, while Yasodharapura is in the very center of that zone.



Map A



Map B

Why the capital was placed in the middle of the region with the highest water table

This very strong spatial correlation causes us to ask why regions with high water tables were preferred centers of settlement. I will argue, first, that high subsurface water levels increase agricultural productivity in several ways, and, second, that the labor requirements of Khmer urban development were most easily met when urban sites were placed amidst regions of high agricultural productivity.

The uses of high water tables

Observation of contemporary farming practices indicates that high water tables make three distinct contributions to Cambodian agronomy. First, high water tables make rice culture more productive, especially in a region of poor, sandy soils such as central Cambodia. These poor soils can supply only modest amounts of nutrients to the rice plants. But rice, originally a swamp plant, can obtain nutrients that are dissolved in ambient surface water as well as from the soil [Grist 1958]. Rice farmers surround their fields with low dikes to prevent runoff, thus keeping water, and the nutrients it contains, inside the fields. But while dikes can prevent rainwater from running off horizontally, they cannot prevent it from infiltrating vertically, down into the soil. During weeks of steady rain, when the volume of rainfall is greater than the volume that sinks into the soil, water remains in the rice field, and the rice plants can receive nourishment. When the rain is intermittent, however, water sinks into the soil faster than it is replenished, the fields dry out, and rice plants can no longer receive nutrients from ambient surface water.⁹ Infiltration is particularly severe in Cambodia, with its highly permeable sandy soils.

But infiltration ceases to be a problem if the water table is close to the surface even before the rainy season begins. In this case, the soil between the water table and the surface is quickly filled by infiltrating rainwater; in other words, the water table rises to the surface as the rainy season proceeds. Once this happens, the rice fields become inundated and remain so throughout the rest of the rainy season, and even for some weeks after its end, so that ambient surface water continuously supplies nourishment to the rice plants. Moreover, the higher the water table is to begin with, the sooner the rice fields are inundated, the longer the inundation lasts, and the more nutrients the rice plants receive over the course of the growing season.

There are two additional ways in which regions with high water tables are more productive than regions with lower water tables. High water tables enable domestic animals to more easily survive the dry season. As the dry season continues, many surface water features dry up. Humans can collect and store enough rainwater for their own survival, but not enough to sustain livestock, who thus need

groundwater. Naturally, the closer the groundwater is to the surface, the easier it is to reach, especially with the few and poor tools available to traditional farmers. In addition, high water tables make the cultivation of fruit trees and vegetables more productive. A high water table means that more moisture reaches the roots of trees, leading to higher yields, and a very high water table may enable farmers to plant a crop of vegetables in the still-wet soil after the rice harvest has been completed.¹⁰ In short, relocating the capital from Hariharalaya to Yasodharapura at the end of the ninth century moved the Khmer center of settlement from a smaller, less agriculturally productive area to a larger, more productive one.

Agricultural productivity and urban location

The movement of the capital from Hariharalaya to Yasodharapura entailed not only the construction of an entirely new city but also the diversion of a river, and the creation of the 15-square kilometer Eastern Baray, all at roughly the same time. An enormous labor force was needed to build these gigantic works. Where did this labor force come from?

At one time, it was believed that the ancient Khmer used irrigation from the great *barays* to grow a dry-season rice crop that supported a large permanent urban workforce; but the *barays*, for all their surface area, were not very deep and could not have provided enough water to grow dry-season rice to support tens of thousands of urban workers and their families [Acker 1998]. Turning away from the idea of a permanent urban work force, we see at once that, as elsewhere in mainland Southeast Asia, an available workforce could be assembled from rice farmers and other agricultural workers in the countryside once the farmers had completed their rice harvest soon after the end of the rainy season. This rural-based work force would have been available annually for the six months from December through June.

As was almost universally the case in traditional mainland Southeast Asia, the labor force that built the temples and *barays* of Angkor was likely divided into two halves. One half was put to work during the days of the waxing moon and the other half during the days of the waning moon; during the half-month they were not employed on public construction projects, the workers in all likelihood returned to their home villages. This system of biweekly labor rotation would have worked efficiently only if the workers lived within one or, at most, two days' travel from their urban work place, not dozens or hundreds of kilometers away. In other words, the system worked best if the urban work site were situated in the midst of a large, densely settled agricultural zone. The relocation from Hariharalaya to Yasodharapura was a move from a smaller, less productive and therefore less pop-

ulous region to a larger, more productive, and more settled region—to a region, in other words, where the large labor force needed for the urban works of Yasodharapura and, later, of Angkor was readily available.

Conclusion

This research, corroborating the work of earlier scholars, demonstrates a strong correlation between high water tables and the locations of medieval Khmer centers of settlement, reflecting in turn the more productive agriculture found in areas of more abundant groundwater resources. This was the Khmer response to the problems posed by the nutrient-poor, very permeable sandy soil characteristic of the Cambodian plain.

The peoples of mainland Southeast Asia each developed agricultural adaptations best suited to their environments. The Dai peoples in the hill country developed the weir and canal system; the Mon, in the meandering river valleys of the lower Chaophraya and the Khorat, developed moats around sites that made use of the many river bends in that habitat. This research demonstrates that the Khmer, on the broad but relatively infertile Cambodian plain, developed their own characteristic form of agriculture, one that could take advantage of the strengths and counteract the weaknesses of their environment.

Acknowledgments

I would like to thank Hang Peou and Bun Sonnaroth of the Department of Water and Forestry of the APSARA Authority in Siem Reap, without whose help and cooperation none of this research could have been carried out. I also want to express my gratitude for the generous support of the Fulbright research program of the U.S. Department of State, which made this research program possible.

Notes

¹ In an earlier paper [Acker 1998], I estimated the depth of the Western Baray at around 9 meters, with proportionately greater water-holding capacity. But, while the titanic walls of the Western Baray would have permitted it to hold 9 or more meters of water, such a water depth would have submerged the Western Mebon, the island-temple in the center of the Western Baray. I am indebted to Christophe Pottier, head of the Siem Reap office of the EFEO, for this observation.

² Rasmussen's survey of subsurface water resources, the first of its kind, was of course intended to create the groundwork for water-use policies in the present, and not to conduct historical research in any sense.

³ Note also that Angkorian historical sites are depicted as solid squares.

⁴ It is true that the water table immediately around Hariharalaya is almost as high as the area around Yasodharapura. There are 25 data points located within 3 kilometers of the Bakong, the main temple at Hariharalaya, of which 10 points, or 40%, are very high, another 40% are high, and the remaining 20% are mid-level. But the area of high or very high water tables around Hariharalaya does not extend far. To the southwest, south, and southeast, the Great Lake approaches to within 3 or 4 kilometers of the city during the rainy season; to the east and northeast, the very high water table around the city gives way to a mixed region of high and mid-level water tables within 3 kilometers. The only directions in which the water table remains high are to the west and northwest, toward the new capital of Yasodharapura.

⁵ Using this date to reach conclusions about Angkorian agronomy obviously rests on the assumption that the amount of rainfall during Angkorian times closely approximates contemporary rainfall totals. Indirect evidence supports this conclusion. The work of Kummu [personal communication 2004] suggests that little if any sediment has been deposited in the Great Lake in the past five thousand years; meanwhile, the locations of Angkorian and contemporary settlements along the shore of the Great Lake suggest that the shoreline has barely moved since Angkorian times. But the volume of water in the Great Lake is a function of precipitation and drainage in the Tonlé Sap basin on the one hand and the volume of water stored in the lake during the time of reversed flow of the Tonlé Sap River from the Mekong mainstream in the second half of the rainy season [Fisher 1963]. If the surface area and the depth of the Great Lake, that is to say, the volume of water in the lake, have not changed significantly since Angkorian times, this must mean that the amount of precipitation over the Mekong drainage basin as a whole and over the Tonlé Sap basin have not changed significantly since then.

⁶ Measured from Phnom Bakheng, the temple-mountain at the center of Yasodharapura.

⁷ The very highest water table in Siem Reap province is in the area once occupied by the Eastern Baray. Even in the middle of the dry season, the water table here is less than a meter below the surface of the ground. It is probable that this area was under water for much of the year even before the Angkorian capital was re-sited just to the west, and that only minor dredging and circumvallation were needed to convert this seasonal swamp into a *baray*.

⁸ Prasat Don Ok, Prasat Loeuk Prey, Prasat Don Tuk, and Prasat Laongieng. This is perhaps the densest cluster of Angkorian settlements outside the capital district.

⁹ Higham [1989] notes that Cambodia is often subject to droughts in July and August, halfway through the rainy season.

¹⁰ This is the contemporary practice in the very high water table in and to the south of the Eastern Baray.

An Archaeological Strategy for Phnom Bakheng

Prasanna Weerawardane and Chhan Chamroeun

World Monuments Fund, Siem Reap

“His Majesty Paramasivaloka founded the Royal city of Sri Yasodharapura and led the God-King (Kamraten Jagat ta Raja) from Hariharalaya to this city. Then His Majesty Paramasivaloka erected the Central Mount. The lord of the Sivasrama founded a holy linga in the centre.” - Sdok Kak Thom inscription

The Prasat Phnom Bakheng was the state temple of the first city of Angkor. Yasovarman I (whose name means “protected by glory”), son of Indravarman I, moved the state capital from the Roluos to Angkor. The temple was the first and foremost example of the temple-mountain style, representing the dwelling place of the Hindu gods, Mount Meru. The foundation stele gives the date of dedication as A.D. 893. Yasovarman chose Phnom Bakheng for his Yasodharagiri, “Mountain of Yasovarman,” the site of the Vnam Kantal, the central temple of the *devaraja* (god-king).

Yasovarman built two moats around his centerpiece. The outer rectangular moat measured 4 kilometers square and 200 meters wide, and the southwest corner of it can still be seen by air. The inner moat measured 650 by 436 meters, and was traversed by four *gopuras* (shrines).

The city enclosed an area of about 16 kilometers square, much of which was probably a combination of villages and markets interspersed with rice paddies. Axial causeways, 12 to 13 meters wide, ran from the base of the mountain to the limits of the city in the directions of the four cardinal points.

Besides the immense outer moat, about 800 artificial water ponds have been discovered in the city. These are either square or rectangular and are arranged in a geometric pattern around the base of the Bakheng and along both sides of the axial avenues.

This is the accepted wisdom of Phnom Bakheng, taken from the Sdok Kak Thom inscription. We asked ourselves questions along the following lines:

- a. *What is the archaeological evidence for the Bakheng being the Yasodharagiri of Yasovarman?*
- b. *Has the temple of the Bakheng been comprehensively dated as belonging to the earliest period of Angkor?*

Initially, we had looked at the Bakheng and thought that we could carry out test excavations in the moat area, as well as areas on the main eastern axis of the causeway at the bottom of the mountain. We discovered, however, that this might not be the most appropriate strategy if our goals were to encompass the above questions. The oldest inscription referring to the Bakheng is from the time of Rajendravarman

II in the late tenth century. The Yasodharagiri was “renovated” then. There are no inscriptions dating from Yasovarman’s time. Indeed there is no inscriptional evidence that Phnom Bakheng is Yasodharagiri.

The Sdok Kak Thom inscription, which details the installation of the king at Yasodharagiri, dates from A.D. 1052, long after the event.

As archaeologists, our focus should be on discovering any evidence there may be that comprehensively proves or disproves the theory that the Bakheng is the Yasodharagiri of Yasovarman. It must be stated at the outset that in our view the location of Yasodharapura, the first city, cannot be traced from the remains of Phnom Bakheng. Where Yasodharapura stood in relation to the Bakheng is now buried under the occupation layers of the present day. While it is possible that such remains of Yasodharapura may still be in evidence in the lateritic soil of Siem Reap, we cannot vouch for any evidence from the Bakheng to pinpoint its location.

From our archival research of the considerable amount of primarily photographic and textual data held at the *École française d’Extrême-Orient* (EFEO), we realized that we would have to rethink our original archaeological strategy. From the evidence of the photographic log from the 1920s, we got a very clear picture of the extensive removal of detritus and topsoil from all levels of the Bakheng. It appears that topsoil up to at least 2 meters was removed from the temple-mountain in the 1920s. Such extensive removal of topsoil would have destroyed the original stratigraphy of the Bakheng. In addition, we have no record of where this topsoil was deposited. It may be that some of this was dumped in the moat area, which would make any test excavations in the moat impossible to quantify stratigraphically.

This removal of evidence has narrowed the archaeological options available to us. Central to the archaeological strategy at the Bakheng is the objective of clearing a visitor pathway around the base of the monument. At the present time, there is no safe route, the base being littered with fallen stones, architectural pediments, and pieces of statuary. There is an urgent need to clear a pathway around, and this would require a primary focus on mapping all fallen stones around the base prior to moving them to a safe location nearer the base of the Bakheng.

In addition to this primary objective, we would also like to focus on three secondary archaeological objectives

1. The uppermost level of the temple-mountain, which has remains of some structures. We propose to excavate a small test area to the bedrock at one of the corners. The reason for this excavation strategy is to determine what if any evidence is in situ here. It may be that some traces of evidence for the earliest building phases are left. Negative evidence will help our overall archaeological strategy.

2. The area encompassing the temple foundation at the base of the perimeter wall. Although this is one of the areas where large topsoil loss has occurred, there may be some evidence of the occupancy levels during the Bakheng's long history. We propose initially to excavate a 1-by-1 meter trench at the base of the temple, and then to extend it in sections up to the perimeter wall.

3. There are many postholes left in the Bakheng, at the top level particularly and in the perimeter on the plateau. It is our contention that these postholes, which seem to have been largely ignored in previous excavations, might yield quite valuable evidence for occupancy phases and dating. We have identified particular postholes that we think may yield good evidence.

The posthole excavations, in particular, may show some organic remains, particularly floral evidence, which may prove valuable as an index of vegetative changes that may have occurred over time in the Bakheng environment. This may give us a window to any macroclimatic shifts at Angkor during the early periods, as well as the post-classical era. Any floral evidence found would be quite significant in the overall context of Angkorian history.

There may be pottery, ceramic, and tile evidence forthcoming from the base excavations that gives a window into periods of occupation. We hope that these archaeological strategies will yield as much information as possible. For a temple site such as Phnom Bakheng, which has been a landmark in Angkor since the earliest times, it is hoped that layers of evidence might still exist to help answer some of the outstanding questions regarding Angkor.

The workforce resources currently available for the Phnom Bakheng project would be adequate for these tasks: after the primary archaeological objective has been successfully met, the three secondary objectives could be carried out concurrently, with a much smaller workforce.

We propose that the above four strategies are the best archaeological options available to us. We look forward to archaeological evidence adding to the quantum of knowledge on the Prasat Phnom Bakheng.

Acknowledgements

The authors wish to thank Christophe Pottier of the EFEO for the considerable help given in advice and making available the EFEO archives.

Introduction to the Environment and Landscape

Jean-Jacques Dupuy, Association des Amis d'Angkor

The Angkor landscape, particularly the landscape of Phnom Bakheng, raises a fundamental question with respect to the historical controversy regarding the occupation of this area, which was the development site of a Southeast Asian civilization that enthralled the western world. So great was the European fascination that Khmer civilization became the focus of important research and rehabilitation budgets.

The concept of landscape is unlikely to have existed in the Khmer empire, at least not in the present-day meaning. The landscape structure was dominated by the quest for the symbolic expression of this society's foundations. The temple-mountains symbolically refer to Mount Meru, the gods' mountain dwelling-place at the center of the universe. Life-generating water is present everywhere, and the organization of moats, ponds, and waterways also refers to symbolic values. In a modern reading of the landscape we must also introduce the functional values of some spatial configurations that shape the space and give it a specific and unique character.

One of the most controversial issues is the status of the area with respect to agricultural use. It may be stated without doubt that the *phnom* were not cultivated because of their slopes and geological nature. Conversely, all sub-horizontal and flood-prone areas may be thought of as rice paddies and also as fruit-producing areas, either from trees (coconuts, bananas, jackfruit) or from shrubs (papayas, mangoes, etc.).

Images of how this amphibian territory devoted to mixed cultivation must have appeared may be sought in other countries that were part of the Khmer Empire. Unfortunately we have no description of the empire's "landscapes" at different stages of development. The bas-reliefs themselves depict nothing more than scenes of daily life, battles of men or gods, and founding myths. There is little room for vegetation in the iconography carved in the stones.

Native landscape, landscape of the empire's establishment, of its decline, of its fall into oblivion, landscape witnessed by famous merchants, landscape rediscovered by the colonizing army corps, landscape of vivid emotion, decaying landscape under tourist pressure.

The predominance of forest in all the enclosures of the cities that succeeded each other on the Angkor site is evident through elementary reading of satellite imagery. It may even be seen that the Eastern Baray is totally overgrown with forest today and is becoming a privileged medium for uncontrolled urban development.

Present day problem areas

Phnom Bakheng's tree envelope heightens its aesthetic value and allows it to be discovered gradually. It also isolates the site and the monument from the context and contributes to a more mysterious climate. The attractiveness of Ta Prohm derived from the heavy pressure of the tropical forest on the monument. Unfortunately, as may have been observed for the past ten years, the condition of this area, which was to be protected, has lost a great deal of its mystery. The recent controversies still demonstrate that the vegetation issue and thus the issue of a picturesque landscape founded on the relationship of vegetation and architecture has yet to reach a final consensus.

Should Phnom Bakheng keep a vegetal image through isolation by clear peripheral cuts? Should it be given a landscaped image? On what basis can clearing and viewing cones be cut without weakening the environment? Should or must the presence of vegetation be strengthened? These many questions must be clarified prior to renovating the site and its major monument.

Operational assumptions

An important prerequisite approach would be to draw up a precise inventory of the vegetation cover of the *phnom* in order to identify the vegetal composition of the various layers (herbaceous, shrubbery, and tree). This valuation, including the environmental requirements of this vegetation, should assess the weaknesses of this particular ecosystem and propose self-regulation generating solutions.

Hang Peou, the APSARA Authority's forestry expert, reports elsewhere in this publication on natural data, the condition of the vegetal environment, and future policies envisaged to confirm its stability and efficiency, as well as its possible strengthening in the performance of Phnom Bakheng.

Some proposals, already formulated by Cécile Califano, a landscape architect for the APSARA Authority, consist in implementing solutions for access-control of the temple. These solutions deal with all questions related to the functionality of the site as raised by a number of visitors, and they call for suitable and durable technical and landscaping solutions.

- The first requirement is to master access and discovery conditions of the monument and of the site as a whole.
- The second is to regulate activity on the site, ensuring both visitors' safety and their education.
- The third is to manage the views from this site, which is the most prominent elevation within the Angkor area.

Indeed we refer here to landscape development based on the existing situation.

Vegetable environment: perspectives and objectives

One of the most interesting features of the vegetation is that it moderates both the landscape and the climate of the place. The potential value for this type of site should be well identified: it is essentially expressed in a relationship between architecture and landscape. We must identify and manage reference phenomena and their pre-eminence in terms of historical tourist practice and protection of future archeological research potential.

Surface and seepage water hydraulics

Water management is an essential prerequisite of success because it greatly affects the stability and perennial existence of the monument as well as that of the *phnom*, which bears the entire pressure of access to the summit.

Forest Management in Angkor Park

Hang Peou, Department of Water and Forestry, the APSARA Authority

Abstract

The census of trees in Angkor Park was conducted by the Department of Water and Forestry, APSARA (Authority for the Protection and Management of Angkor and the Region of Siem Reap), to evaluate the present status of forests in this region. The survey was carried out in almost 38 temples in the Angkor region, and 7,379 trees were recorded in a database that includes detailed information and links to photos (whole view, stem, branch, leaves, flowers, and fruit) of each type of tree.

From these statistics, all of those trees were classified into 154 scientific names, 116 genera, and 43 families. This database was used to create name panels for trees in the park and for selecting species for reforestation in the region as well as conservation of old trees and their replacement. About 6,854 trees have been planted in the archeological park and more than 14,739 seedlings are ready for distribution to schools and villages for reforestation in the Angkor region.

1. Introduction

During the past five years tourism to the Angkor Park area has been growing radically. The economy of Siem Reap province is better than others, as Siem Reap has experienced a significant increase in population living both in the town and Angkor Park. As land prices in town escalate, illegal logging is being conducted in Angkor Park (Protected Zone 1 and Zone 2) for many purposes such as housing and construction materials, fuel, and agricultural practices [Hang 2004]. In Cambodia, more than 90 percent of cooking fuel comes from burning wood. These factors accelerate the destruction of forests in the park.

The deforestation may lead to accelerated climatic changes—less humidity and higher temperatures—that can be a significant cause of the destabilization of temples in the Siem Reap/Angkor region. It is essential, therefore, that Angkor Park's forests be protected

In August 2004 the APSARA Authority created a new Department of Water and Forestry that is responsible for water and forest management, reforestation, air pollution monitoring, and weather study. In this paper, presented during the department's first year of activities, only the forest management fieldwork in Angkor Park was selected for a discussion of the present status of forests in region.

2. Activity of the department and methodology

As is already known, in Angkor Park the forest cannot be separated from the tem-

ple; it plays a very important role in creating the microclimate and soil humidity that have direct relation to the stability of the temples.

Based on aerial photography and field visits, deforestation in the park is very widespread (fig. A.1). The main cause of deforestation, as already mentioned in the introduction, is illegal logging by locals. Therefore, it is necessary for local people to understand the problem and to participate in its solution. The APSARA Authority must create work for them to reduce their activities in the forest.

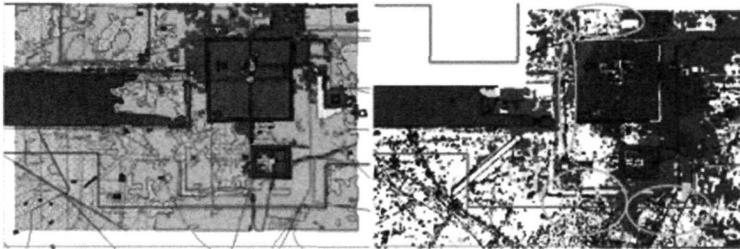


Fig. A.1 - Comparison of the forest in 1964 and January 2005

The Department of Water and Forestry has integrated local people in their regular activities and educates them about the impact and long-term effect of the destruction of forest and groundwater at the temples. The department currently employs sixty-six local people as workers in reforestation, forest cleaning, composting, the botanical garden, the nursery, and water management. The number of workers will be increased to 130 in February 2006. Below some of department's forestry activities are presented in brief.

2.1 *Tree survey information*

It is important that surveys are carried out before management decisions are made regarding treatment of ancient trees, the nursery, and reforestation. Surveys are carried out in three steps: (1) around the temples, (2) along the road to the temple, and (3) in the forest of the Angkor region. Surveys should include for each tree the scientific name, species, family, age (to be measured in a future project phase), size, condition, and associated wildlife interests. (Wildlife assessment will be done in Step 3).

Steps 1 and 2 have archived the recorded information of the trees at almost thirty-eight temples and roads to the temples (including the Small and Big Circuits). (See table A.2 in the annex to this paper.) The trees at each temple are numbered and projected onto the temple map. From the map of each temple we can identify and verify all information on any tree of interest. For the name of the tree, the depart-

ment has decided to use the scientific name and Khmer name, rather than the English or French. Surveys have been carried out on 7,379 trees, which have been classified into 154 scientific names, 116 genera, or in 46 families. In Cambodia, the names of some trees vary from one region to another. To avoid confusion, the department has engaged local people who recognize local names.

2.2 Names of trees in temples

Survey information permits the department to produce name panels for selected trees for the benefit of tourists interested in the biodiversity of the forest at Angkor. Remarkable trees or ancient trees that are well positioned for viewing by tourists were chosen for the name panels. About 600 panels were installed at twelve temples. The next phase was to have begun at the end of January 2006 with 935 panels in eight other temples and the Small Circuit (table A.2 in the annex).

2.3 Conservation

Ideally, all old trees should be retained, including trees that would conventionally be described as unhealthy. In the park, there exist both old and young trees that need maintenance to allow them to thrive.

In the past, local people tapped big trees for resin. As a result, those trees have decayed and died one by one. To save the trees, treatment is necessary. After observation on site, the department found that most cases of decay were caused by the infiltration of rainwater, so the classic method of treatment can be used. The first step of treatment is to clean the infected areas and remove any stored rainwater; the second step is to introduce a layer of waterproof coating.

Old trees that have stood for more than forty years in the Krovan village of Angkor Thom commune have been brought to near collapse by farmers of this village who plow around the root collar. The department cooperated with the commune to save those thirty-eight trees by filling back the root collar. Another group of more than thirty old trees near the Ta Prohm temple have the same problem to be resolved with villagers.

To maintain the young forest, the department has cleaned 1,036 hectares along Road 60m and west of the Krovan temple, and also has built a firebreak road to protect the forest from accidental fires in the dry season.

Replacement of old trees or hazard trees by young trees or saplings of the same species is necessary to save the biodiversity of the region as well as to preserve the landscape.

2.4 Nursery

From the tree survey information, the department can locate healthy trees for the purposes of seed collection. Since different tree species' flowering, fruiting, and seed distribution take place at different times throughout the year, seed collection for growing new seedlings must be done continuously, all year long. The nursery (see fig. 11 in folio) currently has 14,739 seedlings representing eleven species trees (table A.1).

2.5. Reforestation

The Department of Water and Forestry has developed a reforestation plan in the Protected Zone 1 and Zone 2 and also in Phnom Kulen. For this plan, the department has outlined three approaches: (1) by the APSARA Authority itself; (2) by providing technical and material support to schools, which would mobilize students to plant trees on their grounds; (3) by encouraging villages in the region to plant trees near homes for daily use, also with support from the APSARA Authority.

The department has a general concept for reforestation in which two flexible zones are designated.

- a) Forest (Protection Zone)—a mixed-species forest plantation, representative of the original forest species in Angkor and providing habitats for birds and wild animals.
- b) Temporary Zone (Buffer Zone)—plantations of fruit trees and trees for fuel, situated between the village and forest zone and reserved for everyday life in terms of agricultural consumption for the villages.

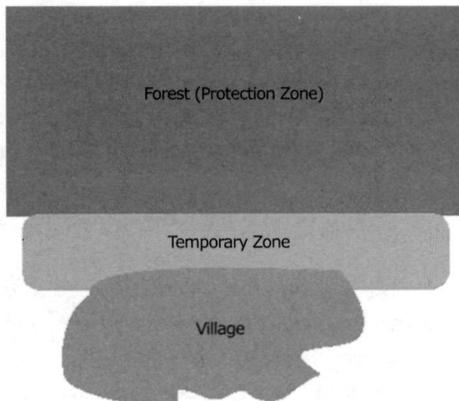


Fig A.2 - General conception of reforestation (Hang, 2004)

In August 2005 the APSARA Authority planted 6,854 trees to the west of Road 60m in Protected Zone 1 with participation from monks, the provincial governor, teachers,

students, and local people. Six species of tree have been planted, including *Dipterocarpus alatus* Dipterocarpaceae, *Afzelia xylocarpa* Leguminosae-caesalpinioideae, *Hopea odorata* Dipterocarpaceae, *Sterculia parviflora* Sterculiaceae, *Hopea recopei* Dipterocarpaceae, *Cassia siamensis* Leguminosae-caesalpinioideae.

Two primary schools, Angkor Thom and Donn Oeuv, have accepted a proposal from the department to reforest in their schools in January 2006. The department provided the saplings, compost, and technical staff to assist in this work.

As mentioned in the general concept for reforestation, the Temporary Zone is being created for villagers—and to be most effective must be planted by villagers with support from the APSARA Authority. This idea can help villagers save money for firewood by planting local species along their property boundaries or fences, such as the fast-growing species Angkanh (*Cassia siamensis* Leguminosae-caesalpinioideae) and Angkheadei (*Sesbania grandiflora* Leguminosae-papilionoideae). The APSARA Authority has supported Ampile village in the Bakong district in planting five hundred trees, of which two hundred are Beng (*Afzelia xylocarpa* Leguminosae-caesalpinioideae) and three hundred are Cheuteal (*Dipterocarpus alatus* Dipterocarpaceae).

2.6 Compost

In the past, dead tree leaves in Angkor Park were collected from public places (temples and roads) and moved into the forest. In the dry season the dead leaves in this forest pose a fire hazard. The department is building a compost station in Mundul 3 of the Angkor Thom district. The purpose of composting is (1) to keep the forest clean at all times and to prevent accidental fires in the dry season and (2) to fertilize the soil for the nursery and reforestation.

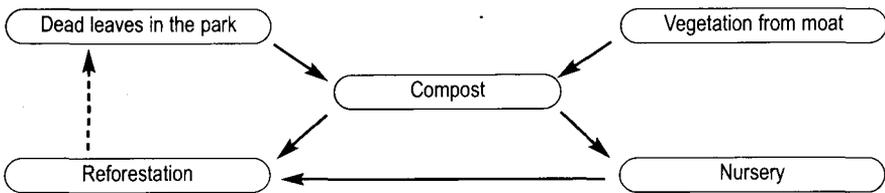


Fig. A.3 - Diagram of dead leaves and vegetation cycle

The APSARA Authority has subcontracted with the private company HCC to collect dead leaves in Angkor Park and remove vegetation from moats (Angkor Wat and Sras Srang). HCC thus can bring this material to the compost station. The department began this work in March 2005 and has produced 25,000 kilograms and

42 cubic meters in the process. Generally, in the dry season the process takes 4.5 months and in the rainy season 3 months.

3. Phnom Bakheng

The temple-mountain of Phnom Bakheng is the only temple in Angkor Park to be visited by thousands of tourists each evening. The forest on the slopes of this temple plays a very important role in protecting the hill. In the Steps 1 and 2, the tree census recorded only those trees at Phnom Bakheng situated near the tourist access way. The forest on the slopes is slated to be surveyed in May 2006, but a draft study shows that the majority of the species on the slopes are Krolanh (*Dialium cochinchinense* Leguminosae-caesalpinioideae), Lngeang (*Cratoxylum cochinchinense* Guttiferae) Semean (*Nephelium hypoleucum* Sapindaceae) and Bampenh Reach (*Sandoricum koetjape* Meliaceae).

Phnom Bakheng has many young trees requiring the maintenance of a clean forest in order to improve growth. Forest cleaning is not meant to clean herbaceous plants, which play an important role in protecting soil on slopes from erosion caused by direct rainfall and runoff. A firebreak is also needed to protect the forest from accidental fires in the dry season.

Reforestation and replacement of old trees is necessary to preserve biodiversity and the landscape, to reduce erosion, and also to save microclimates that assure the stability of the slope and the environment of the site.

One serious consequence of soil erosion is the concentration of surface flow on the slopes; this can eventually undermine and topple trees or cause landslides. A drainage system is needed to control the flow.

4. Conclusion

Forest management in Angkor Park is very important to safeguard the temples and protect sources of water. As is already known, "no water, no sustainable development," so forest management is required not only in the park near temples but also on Phnom Kulen, which is the only significant source of water to assure the permanent flow of the Siem Reap River in the dry season.

Acknowledgements

The author would like to express sincere thanks to the World Monuments Fund for organizing with the APSARA Authority the Phnom Bakheng Workshop on Public Interpretation to share experiences in safeguarding the Bakheng temple and its environment. Meanwhile, I would like to thank the staff of the Department of Water and Forestry of the APSARA Authority for its kind cooperation.

Annex

Table A.1
List of trees in the nursery

| N | Khmer name | Scientific name | Family |
|----|------------|---------------------------------|------------------------------|
| 1 | KOKI | <i>Hopea odorata</i> | Dipterocarpaceae |
| 2 | CHHEU TEAL | <i>Dipterocarpus alatus</i> | Dipterocarpaceae |
| 3 | RUMDUOL | <i>Goniothalamus repevensis</i> | Annonaceae |
| 4 | POPEL | <i>Hopea recopei</i> | Dipterocarpaceae |
| 5 | BENG | <i>Azelia xylocarpa</i> | Leguminosae-caesalpinioideae |
| 6 | THNONG | <i>Pterocarpus indicus</i> | Leguminosae-papilionoideae |
| 7 | TRACH | <i>Dipterocarpus intricatus</i> | Dipterocarpaceae |
| 8 | KHNOR PREY | <i>Artocarpus rigidus</i> | Moraceae |
| 9 | SEMOAN | <i>Nephelium hypoleucum</i> | Sapindaceae |
| 10 | ANGKANH | <i>Cassia siamensis</i> | Leguminosae-caesalpinioideae |
| 11 | CHUNLUH | <i>Lepisanthes rubiginosa</i> | Sapindaceae |

Table A.2 - Number of trees and panels for each temple

| N | (Temple) Name | Trees | Panel name of tree | N | (Temple) Name | Trees | Panel name of tree |
|----|-------------------|-------|--------------------|----|-------------------------------------|-------|--------------------|
| 1 | Outside of Angkor | 386 | | 22 | Tob east | 38 | |
| 2 | Inside of Angkor | 511 | | 23 | Banteay Samre | 79 | 39* |
| 3 | Bayon | 382 | 91 + 1* | 24 | Batchoum | 43 | |
| 4 | Lean Choul Damrei | 178 | | 25 | Katouk | 62 | |
| 5 | Phi Mean Akas | 154 | 43 + 1* | 26 | AnnTray | 26 | |
| 6 | Palai Lay | 196 | 71 + 3* | 27 | Preah Pithou | 22 | |
| 7 | Bakheng | 128 | | 28 | Sok khai yea nea | 44 | |
| 8 | Takeo | 122 | 50 + 1* | 29 | Kau Sork | 15 | |
| 9 | Chaosay Teveda | 64 | | 30 | Bakong | 85 | 26* |
| 10 | Thormanun | 45 | 21 | 31 | Preah Kho | 29 | 16* |
| 11 | Banteay Kdei | 257 | 56 + 3* | 32 | Llei | 60 | 28* |
| 12 | Krovan | 47 | 15 + 3* | 33 | Ak Thvea | 46 | |
| 13 | Prerub | 35 | 15 + 3* | 34 | Phnom Krom | 25 | |
| 14 | Mebon oriental | 77 | 14 + 1* | 35 | Prei Monty | 26 | |
| 15 | Ta Som | 172 | 57 + 2* | 36 | Ta Prom | 241 | 99 + 11* |
| 16 | Kraul Kho | 49 | | 37 | Preah Khan | 222 | 68 + 1* |
| 17 | Neak Pean | 181 | | 38 | Circuit of Runtadeav to Boeung Thom | 275 | 71* |
| 18 | Prei | 25 | | 39 | Small Ring | 1646 | 541* |
| 19 | Banteay Brei | 38 | | 40 | Big Ring | 429 | |
| 20 | Banteay Srei | 93 | 29* | 41 | Kbal spean | 423 | 81* |
| 21 | Taney | 193 | | 42 | Beng Mealea | 210 | 74* |

Note: * Panel to be installed in February 2006

Angkor Site Planning and Phnom Bakheng's Landscape

Cécile Califano, Department of Monuments and Archaeology 1, the APSARA Authority

Angkor Park site planning by the Department of Monuments and Archaeology I (DMAI)

This paper briefly presents some of the studies prepared by the Surrounding Management Unit, the APSARA Authority, to give an idea of the context in which Phnom Bakheng is situated with regard to visitor-circulation planning and spatial management.

This circulation master plan project has not yet been officially approved, and some proposals are still under study, but some of the bypasses are already realized. The plan shows the two main tourist routes and the network of what we call the "parvis," or "approach areas."

Each parvis is planned as a central location for all tourist facilities related to an individual site: parking area, shops, toilets, and information. The position of each is determined according to three principles

- Gather the arrivals so that all visitors enter the site from the east, the historical and traditional entrance to the temples.
- Create some distance between the parvis and the temple. Together with enhancement of the surroundings, this will help visitors to understand the site and prepare for their visit.
- Keep the space between the visitor entry point and the temple open and free as a protective buffer zone.

The parvis concept is especially useful in that it clears specific areas from archaeological constraints; a preventive archeological survey must be carried out before any of these areas is approved as a parvis.

The parvis plan is also a very good way to control development. Cambodian law forbids development in the monumental zone, except for what is essential to the protection and enhancement of the sites. Tourist installations, therefore, would be reduced to the minimum necessary.

There is a parvis for each temple or group of temples, and the parvis areas work together as a network in which some are more important than others. The hierarchy is as follows:

- Centre d'accueil / main center (in the future, the "Tourism and Culture Zone")
- Three main approach areas, connecting mass transportation with local transportation (Angkor Wat, Preah Khan, and Sras Srang)
- Around twenty others, some of them being only drop-off areas

The parvis planned for Phnom Bakheng is a secondary one: in the future master plan, most of the activities in the sector will be handled in the Angkor Wat Parvis. The Phnom Bakheng Parvis is meant to be the approach area to three points

- Phnom Bakheng
- South gate of Angkor Thom
- Baksei Chamkrong

The parvis zoning here is not so precise as for some others being planned, as the situation here is very complex. The zoning also depends on other measures that should be taken in order to reduce the impact of visitors, such as the development of other circuits, communication with tour operators, and the organization of systems for ticketing and shuttle service. These measures must be implemented in several phases; this is why the APSARA Authority has built a temporary parking area. But if the Surrounding Management Unit's primary undertaking is the parvis program, we are also proposing enhancement programs in specific cases. This is how we made proposals for Kbal Spean and, of course, for Phnom Bakheng.

We first decided to study Phnom Bakheng because we were concerned about the safety of visitors climbing the eastern stairway, and we are also obligated to protect these Angkorian stairs. The APSARA Authority decided to close the stairway. Information boards explain the closure, but improved signage and notification are needed before the safety measure is fully implemented.

As this necessary decision may not be well accepted, the Surrounding Management Unit drafted a proposal for an alternative access route to the top of the hill using the existing path to the north. (This path had been ameliorated in 2003.) The proposal presents enhancement measures taken at the entrance area and on the North Path, providing visitors with shady places to stop on the way and admire the views of the surrounding landscape. At the summit, we proposed a solution that offers visitors new viewpoints while the temple is closed for conservation.

As the World Monuments Fund is not only preserving the temple, but also studying the *phnom* as a whole, the team is now working on integrating the Surrounding Management Unit's proposal into its site interpretation project for Phnom Bakheng.

Phnom Bakheng's Landscape

A hill between forest and rice fields

Phnom Bakheng is situated, on the scale of the whole archaeological park, between the open agricultural landscape stretching out to the south and the forest of Angkor Thom. Since the 2003 Paris Conference, Angkor Forest has been officially identified as a patrimonial element, and more and more measures are being taken to protect it.

(See "Forest Management in Angkor Park" by Hang Peou, director of the APSARA Authority's newly created Department of Water and Forestry, in this publication.)

If we are concerned with the persistence of the rice fields' landscape, we must acknowledge that it depends on the permanence of the traditional land-use system, the stability of which is very difficult to control today, as it is being subjected to population pressure. A large part of the fields to the west of Phnom Bakheng result from swidden agriculture, the development of which should be controlled.

The challenge is to find the balance between forest and fields, the two main landscape formations in the area. I would like to add that this duet echoes that of *srok* and *prei* (the "cultivated" and the "wild"), concepts according to which Cambodian culture defines the environment.

A site at geographical scale

The hill of Phnom Bakheng is the central element of a sequence of three, emerging from the Angkor plain: Phnom Kraom, Phnom Bakheng, and Phnom Bok. At the top of the Bakheng plateau one can locate these rather remarkable geological formations, from the Phnom Kulen to the Tonlé Sap, an area that corresponds to the scale of "Greater Angkor." The hill is therefore very valuable in terms of interpretation: from the height of Phnom Bakheng, the visitor can see the geographical as well as the man-made elements, and comprehend the founding logic of Angkor's civilization, taking measure of the true breadth of its achievements, in particular in the field of hydrology.

A landmark

Historically, Phnom Bakheng has been full of meaning and it is still emblematic today, with contemporary tourist criteria being added. Situated at the core of Angkor Park, this "temple-mountain" is a sightseeing highlight. Its tourist success is mainly due to the tremendous view of the surrounding landscape, certainly more than to the monument itself. Despite the crowd that gathers every evening for the privileged spectacle of the sunset, the site still presents an obvious symbolic strength. But how long will that last?

Let us see to what extent Phnom Bakheng can serve as a landmark. As the area around it is forested, the temple is not visible from all vantage points. The Surrounding Management Unit of the APSARA Authority has emphasized the view to the *phnom* in designing the Angkor Wat Parvis master plan. Indeed, in the future circulation plan, the access road to the Angkor Wat service area will be oriented so as to see the Phnom Bakheng temple in the foreground.

Approaching the *phnom* itself, the summit becomes more hidden. At the base of the hill, the temple is completely invisible; it is to be discovered again, suddenly, upon reaching the top. But it is a landmark also in the sense that, while climbing, the visitor gradually sees different elements of the landscape.

The east entrance, at the foot of the hill, is the meeting point of two contradictory situations: the throng of visitors rushing up the hill every evening, while three hundred meters away a traditional rural landscape extends around two beautiful ponds and the dwellings of families, often living in great poverty, exploiting the resources of the land. The hill is right there, behind the curtain of trees, but the crowd at the top seems very far away.

Still, Phnom Bakheng constitutes a landmark when one circulates in this sector of the park, and in return it allows the climber to position himself in the greater Angkor Park, by offering perspectives on the surrounding structures.

The Panoramic Trail project, established by the Department of Monuments and Archaeology I

The study

The Panoramic Trail was proposed in 2004, responding to the urgent need for protection of the monuments (the temple and the stairs) as well as for the security of the visitors.

It was indeed a question of proposing an alternative to the dangerous and uncomfortable, although popular, east staircase access route. The monitoring conducted by the agents of the APSARA Authority, in particular the site curator, Vong Dara, display impressive images of the dangerous situation in the rainy season. The tourist pressure is also a rather visible threat; details of the precise study can be found elsewhere in this publication. (See Chau Sun Kérya, "Patterns of Tourism at Phnom Bakheng.")

Managing the access routes

I would like to revisit the subject of closing of some access routes to the temple, plans that have been announced but not yet put into full effect. With the current state of tourist pressure and insufficient infrastructure, closure is the solution adopted by the APSARA Authority. The four original staircases will no longer be accessible. The terrace of the temple, however, will close only at 4 PM, leaving open the possibility of access to those who really want to see the temple. Those who come only for sundown will be able to admire the setting sun from other vantage points, which will be developed for this purpose.

After the temple conservation work has been completed, and when the flow of visitors has been balanced, one could then plan to reopen the terrace until the evening. The protection of the monument, in all the cases, must remain a priority.

Returning to the Panoramic Trail project

Advantage should be taken of Phnom Bakheng's singular position. Relatively simple interventions can be implemented in order to improve visitors' comprehension of the site, as well as their comfort. The landscape study "État des lieux et propositions d'aménagements sur le Phnom Bakheng" (Department of Monuments and Archaeology 1, March 2004) comprises a first part, showing the analysis of the views to be emphasized. It is mainly the visual aspect of the visitor experience that is proposed here, since the idea was to establish a panoramic trail (see fig. 8 in folio). The trail project integrates the reports carried out by the site agents, taking into consideration the need for certain interventions aimed at curbing the processes of degradation. It is quite obvious that these measurements must be supplemented, in particular with regard to forest management and the question of water. This study is now integrated in the approach of the team who, having seized what is at stake on the site, is not only working on conservation of the temple, but is considering the hill as a whole.

Following the method

I would like to recall here, even if I do not treat this point in detail, that the whole of the project process—combining all the elements which I have just evoked, as well as the new ideas which will have emerged from this workshop—must take into account the successive phases of the methodological guide established by the APSARA Authority and UNESCO.

Analysis of views

The existing trail, although very little used, already offers very beautiful opportunities. The project aims to allow the discovery of the various monumental elements of Phnom Bakheng, that is, not only the temple, but also the monumental staircases and the more distant Angkorian structures.

The progressive discovery is animated by a succession of visual closings and openings directed to the monuments or to the landscape. Minimal intervention on the vegetation would be enough to emphasize the views, still without making them too obvious.

Proposed interventions

The proposals relate to three principal spaces—the entrance area, the path, and the plateau.

The entrance area is situated at the foot of the east staircase leading to three access ways to the top: the pedestrian path, which circumvents the *phnom* toward the north; the central staircase, which will be closed for safety reasons; and the path on the south side, which is reserved for the elephants only.

For the entrance area, the proposal aims

- To create a reception area for the public, to be connected with the future parvis, on the other side of the road,
- To direct the pedestrian flow towards the Panoramic Trail and to secure the interaction between pedestrians and elephant riders. This requires signage improvement in the area. In addition, it is necessary to ensure protection of the archaeological remains and to manage the drainage in order to avoid erosion.

The path was partially rehabilitated in 2003. Claude Jacques has indicated that the north and south paths date from the 1920s and that they had been constructed, at the time, for safety reasons. The question is thus not new!

For the development of the panoramic path, the proposal recommends the following:

- Clear the visual openings. Light interventions of selective pruning shall open windows onto the landscape. Still, it is advisable to preserve the balance of the forest cover, which prevents erosion;
- Provide places to pause;
- Install a solar light system for a safe descent;
- And let us not forget ongoing maintenance once the grounds consolidation work and water drainage management have been carried out.

The installations on the plateau consist of three principal elements,

1. Installation of a belvedere for the observation of the countryside landscape toward the south
2. Installation of a platform to admire the temple of Angkor Wat, which seems to emerge from the forest
3. Installation of a platform at the top end of the western staircase, in order to satisfy sunset enthusiasts

In all places, the idea is to keep the trees in the foreground and use them to frame the views, softly leading the gaze of the visitor according to his individual experience.

Toward a Multipurpose Interactive Model to Visualize and Stimulate the Phnom Bakheng Temple Area

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I. The Angkor Project Group

The *Angkor Project Group* (APG) is a student collaborative situated both at the Interdisciplinary Center for Scientific Computing (IWR) of the University of Heidelberg and the Royal University of Fine Arts (RUFA) in Phnom Penh. The triggering idea for establishing the APG in January 2005 was the joint effort of both universities to strengthen the role of scientific computing as a key research area in the application field of architecture and archeology.

1.1 Scientific computing—key technology for the future

Mathematics in general and scientific computing in particular find themselves less often in the role of a supporting actor for the natural sciences and more and more as key players in interdisciplinary projects. The reason for this development can be found in the ever more demanding problems of information technology that show up in research projects as well as in practical applications.

Mathematical algorithms and their correct, efficient, and stable implementation in computer code are the working field for scientific computing. Their promise of increased performance is one of the lures that the natural sciences has been unable to turn down for more than two decades. But in the last few years, the humanities also have discovered the blessings of computer-based hypotheses testing. The idea of modeling effects from archeology, architecture, or even sociology in the terse language of mathematics and finding answers to ambitious questions using scientific computing simulations has spawned a series of emerging research areas for this branch of mathematics.

The key observation that brought such interdisciplinary projects to success was made at the border between scientific computing and the natural sciences a long time ago: Successfully solving problems at the intersection of scientific computing and, say, archaeology requires neither an archaeologist skilled in numerical mathematics nor a scientific computing researcher with an interest in archeology, but a team of two specialists, one from each field, together exploring new modeling and simulation formalisms and applying the latest theoretical results from both areas to create an innovative solution to the questions posed.

1.2 Educating students

Due to the borderline status of scientific computing inside mathematics, the educa-

tion of students and the selection of promising researchers at institutes such as the IWR have to develop in new ways. Traditionally, a typical doctoral project is not a joint work by two students, so the ideal situation of an interdisciplinary project as outlined above is not feasible inside a single department. Instead, training for interdisciplinary work in collaboration with experts from different fields must start as early as possible.

The APG was thus the logical answer to the ever growing research interest in scientific computing in the humanities. The IWR and RUFA initiated a student collaboration of young researchers from two complementary areas to join forces in a series of projects. These projects were selected based on a shared interest in the Angkor temple area, a region where German efforts in classical restoration met with RUFA's work on sites of Khmer cultural heritage.

Both universities founded student groups of approximately ten students each to start working together on practical problems arising from the everyday labor in conservation programs. The positive and interested response of the students and lecturers, as well as of the media and third party organizations such as the World Monuments Fund (WMF), proves that this approach to educating students and acquiring new knowledge in cultural-heritage scientific computing satisfies the demands of both education and research posed to modern universities.

1.3 First steps of the APG—a timeline

The results of the first year of the APG bear witness to a prosperous and promising development.

- Through the sponsorship of the Gottlieb Daimler- and Karl Benz-Foundation, Ladenburg (Germany), RUFA gained e-mail connection and limited Internet access. Although this might seem to be but a minor detail, modern communication proves vital for a solid and lively exchange of opinions between students living on two different continents.
- Developed from an ongoing PhD thesis at the IWR, the modeling of several temple complexes in the Angkor temple area was achieved. The CAD models needed for the geometric representation were furnished partly as separate projects in Germany and Cambodia, partly as joint projects in mixed student groups.
- In April 2005, a group of four students and a lecturer from Germany visited Phnom Penh and Siem Reap. Over the course of four weeks, they not only collected a vast amount of digitized data to use as a basis for further project work, but also established direct, personal links with the students in Phnom Penh to enhance the dialogue between the two parts of the APG.

- Supported by a UNESCO stipend, a return visit of one lecturer and four students from Cambodia to Germany was made possible in autumn 2005. In eight weeks filled with special lectures, excursions, and interdisciplinary projects, a rich scientific exchange took place, with both groups learning from the other a wide variety of knowledge in the relevant research fields.
- In the meantime, one of the projects defined as a key research area of the APG—modeling buildings based on photogrammetry—was awarded a Karl-Steinbuch stipend by the Media and Film Association (MFG), Baden-Wuerttemberg (Germany). With this nine-month stipend, which runs until spring 2006, Phillip Struck, a member of the APG, has conducted a full-fledged research project based on the ideas and spirit of this interdisciplinary collaboration.

2. Projects and tools

During the first research year, members of the APG compiled a list of possible projects. Starting with a direct geometric modeling of sites in the area around Siem Reap, the group identified several tasks for further investigation and started working on a selection of problems. Currently, three main projects with a series of sub-projects are being pursued.

2.1 Main project 1: Geometric modeling using submodels

In his PhD project, Pheakdey Nguonphan, a Cambodian student at the IWR, is working on the identification of modules for the construction of Angkor-style temples. Starting from the observation that several significant building blocks in different temples in the Angkor area can be found, he introduced a selection of typical building modules. Although a certain building block is not identical over the range of temples of different periods, the individual entity of such a basic building block object can be characterized by a few carefully selected parameters.

Using the building blocks together with the relevant parameter for each entity of a block in a complex temple construction, a computer model of the temple was generated. Such a block-generated model has several advantages.

- Due to the reuse of building blocks, the construction work at the computer can be significantly reduced leading to faster reconstruction times as well as smaller models.
- Based on the parameters for each building block, comparison analysis of different temples of the area is made possible.
- Specialized computer graphic models (including simplified graphics for fast real-time rendering and adaptive level-of-detail methods) can be generated for the basic building blocks. This induces these features into all models using the block structure.

APG students used similar techniques to create models of the Kravann, Phnom Bakheng (see fig. 12 in folio), and the outer area of the Bayon.

2.1.1 Subproject 1.1: Vectorization of line drawings

Several of the building blocks defined in the main project are parameterized by their cross-sectional line. Usually these lines are taken from digital photos or from line drawings by archaeologists. The vectorization of these line drawings was identified as the most tedious and error-prone task. To reduce the time for vectorization and increase the accuracy of the result, the APG started a subproject to extract a vector representation from a scanned black-and-white image.

The tool AngkorVEC was specifically built to tackle this task. Using anisotropic diffusion for the extraction of feature lines followed by a vectorization step on the solution of the diffusion filter, AngkorVEC is capable of deriving vector representations of pediment outlines, basement cross sections and similar line parameters, which in turn can be used to parameterize building blocks of the main project.

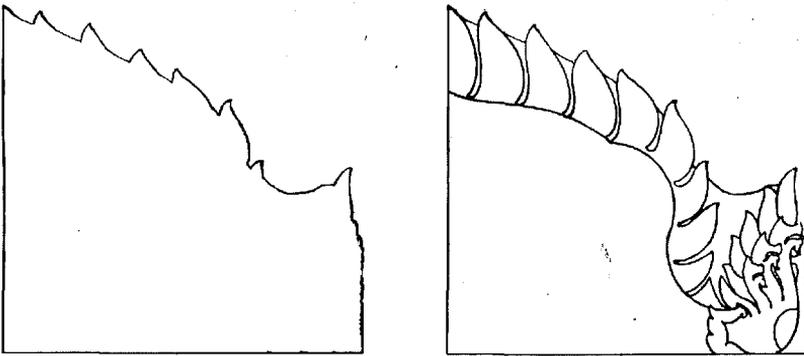


Fig.1. Level-of-detail in a vector graphic derived with AngkorVEC

2.1.2 Subproject 1.2: Shapes-from-shading

To enhance the quality of 3-D CAD models, surfaces are usually equipped with a texture image. These textures are derived from digital photos of the original surface. They are used to represent fine details that are beyond the scope of geometry-based modeling. Further improvements in rendering use bump mapping to create effects of shading on surfaces with a low level of detail.

As is vectorizing line drawings, the task of deriving detailed surface information is cumbersome and prone to error. A modern solution using scientific computing techniques attempts to compute the 3-D structure of a detailed surface from a

single 2-D photograph. Taking the shading represented on the photo, *shapes-from-shading* computes an approximation of the surface details based on minute changes in surface color. Using the prototype application AngkorSHAPE, we succeeded in computing good approximations of the shapes of *apsara* reliefs from Angkor Wat and Phnom Bakheng. Using these in models of both temples gives a much more vivid and realistic impression of the temple area and of the effects of light and shadow on the visual experience. The development of this prototype application is part of the ongoing research at the IWR.

2.2 Main project 2: Terrain generation

For a meaningful and visually pleasing overall model in computer graphics, one needs a detailed and accurate representation of the surrounding terrain. While the mere CAD model might be enough for deciding upon purely architectural questions, even a modest analysis of the historical and interpretive environment quickly leads to questions involving terrain type and structure. Furthermore, questions of the natural cover of the terrain might come into play.

- In the course of reconstruction and conservation of buildings, the water flow in the relevant area plays an important role. Different height levels in different parts of the building lead to different conservation measures. To investigate these topics, a terrain model supplies the needed data.
- Modeling tourist behavior on a temple site requires knowledge of path slopes and track conditions as well as the computation of lines of sight to areas of visual attraction. This calls for a terrain model that includes a basic vegetation scheme.
- The location of different temple areas in relation to each other is interesting for the interpretation of the construction timeline. A basic terrain model together with detailed information about historic vegetation changes is a helpful research tool for queries in this scientific field.

2.2.1 Subproject 2.1: Rendering elevation data

Elevation data of the area of Angkor is given in two data types. From airborne measurements stems *grid data*, which gives information about elevation on a regular grid pattern. While this data can be very accurate, the colossal amount of data leads to serious problems when displaying such models. Even for modestly sized areas the storage requirements for data can be in the range of several gigabytes, usually too large for off-the-shelf personal computers. Projects such as Google Earth show that reduction of data to a manageable size is possible. Bringing such techniques into the models used by the APG is one of several proposed tasks in this subproject.

From field measurements we get a totally different type of data. Here, the terrain elevation is measured only at distinct key point such as corners of buildings, peaks of mounds, or the courses of ditches. The resulting *unstructured terrain grids* use very sophisticated level-of-detail techniques to render the area of a model visible in a computer animation. Due to the sparse structure these data models can be displayed very quickly and leave a significantly smaller memory footprint than grid data. However, algorithms for interactive display of these models are very complicated and usually must be tailored to the relevant application.

2.2.2 Subproject 2.2: Combining terrain and CAD models

Combining terrain and CAD models is an essential task of the APG. While both models individually lead to a range of interesting applications, only the combination of the two gives a complete basis for possible complex tools. This task of combining two models of very different origin might look not too difficult to the untrained eye. But building a combined model that includes both types of data and targets interactive visualization leads to coordination problems at the borderline between the two models. The problems stem from different level-of-detail algorithms used for rendering acceleration.

2.3 Main project 3: Virtual Exhibition of Artifacts and Relics

One of the major aims of the Angkor Project Group from the very beginning was the compilation of a virtual exhibition of Khmer artifacts and relics from several sources around the world. Such a major project leads to several tasks ranging from acquisition of data and cooperation with museums and governmental bodies to algorithms for photogrammetry and coordination of the virtual exhibition with secondary exhibition material such as brochures and catalogs.

Some of the subtasks of this project have already started. A Memorandum of Understanding between RUFA, the IWR, and the National Museum in Phnom Penh, signed in May 2005, was a major official step towards the goal of a virtual exhibition. Building on the values that were formulated in the memo, first models of artifacts from the museum were constructed using techniques of photogrammetry based on digital data taken on site.

2.3.1 Subproject 3.1: Robust photogrammetry for artifacts

In cooperation with Jaroslav Poncar (Technical University, Cologne, and the German Apsara Conservation Project) a review of possible photogrammetry techniques for the computer modeling of artifacts, relics, and statues of moderate size was conducted in autumn 2005. Key questions center around the fast and robust

construction of computer models under working conditions in Cambodia. Challenges include using off-the-shelf digital cameras and working in difficult light conditions in the archives of the museum and on excavation sites. The combination of photos with different color temperature and from limited angles leads to complex optimization problems in the computation of a textured, solid representation of the relevant object.

2.3.2 Subproject 3.2: Combining model fragments

Fragments of some objects relevant to the exhibition are dispersed among several museum locations. This results in a very particular question in the generation of computer representations.

The computer models generated from fragment data result in *computer model fragments* possibly generated with several software tools, which often fail to produce a matching discretization along the common fragment surfaces. This might be due to missing "link fragments" or simply because of different discretization decisions made by the photogrammetry software. Even totally different graining of the surfaces due to different resolution of source images or modeling bases can be observed. Joining the relevant meshes at the fraction surface is long and tedious work. Even a semi-automated approach would lead to significant savings in both time and manpower.

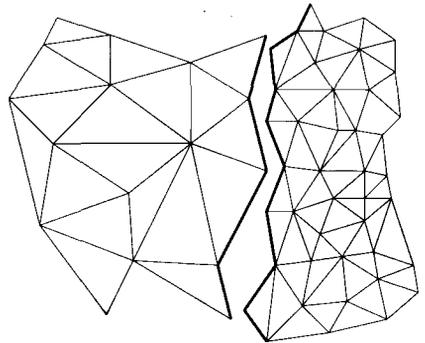


Fig.2. Joining two fragments

3. Applications scenarios

The main projects defined in the previous section further lead to several possible application scenarios. The combination of the subproject results is a major step towards a *multipurpose interactive model for visualization and simulation*. Two of these scenarios are outlined here.

3.1 Visualizing the current and original state of a temple

For site interpretation the comparison of the original and current state of a temple gives valuable insight into the development of a site. Using CAD and terrain models of both periods in combination generates a first visualization tool for the task at hand.

Photorealistic renderings of such models, however, may lead to false conclusions by the observer: Images derived from a photorealistic model—even one based on uncertain data—will give the impression of reliability when visualized on a computer screen. To counter this human reaction, computer graphics use the notion of *non-photorealistic rendering* (NPR). Application of NPR techniques produce images resembling rough sketches, which in turn convey the underlying idea of historical hypotheses discovered in the course of a research project.

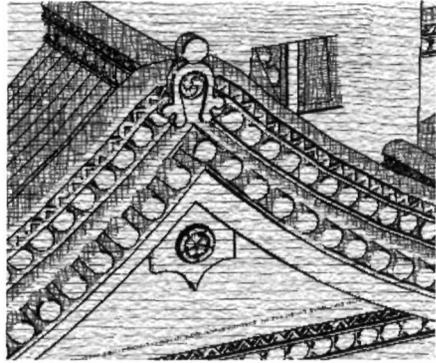


Fig.3. NPR drawing in pencil style

3.2 Modeling Phnom Bakheng using photogrammetry

The modeling of Phnom Bakheng is one of the first projects to use photogrammetry based on standard digital photos for a complex building of such size. While photogrammetry on single objects has been proven to work in several applications [Visnovcova, Zhang, and Gruen 2000], the application to a temple with numerous concave surfaces uses several techniques from the APG subprojects.

A key to the success of the photogrammetry project conducted by Phillip Struck (see above) is to log the position of each photo taken, and then allow the photogrammetry optimization step to determine precise locations for all images with respect to each other.

Formulating photogrammetry as an inverse problem in scientific computing reduces the need to position the camera exactly at different locations on site. Instead, the multiplicity of visual information present in the digital photos is used to simultaneously compute both the shape of the object from which the photo was taken *and* the camera position and orientation parameters of each photo.

Moreover, the resulting 3-D model of the temple is intended to serve as a visual user interface to a database for documentation purposes. Combining computer modeling, interactive real-time animation, and the database thus generates an innovative tool for the fieldwork of a reconstruction team or a visual platform for visitors, offering them the latest information on the conservation project.

4. Conclusion

The projects formulated by the Angkor Project Group of RUFA and the IWR bring together an array of tools from very different areas of scientific computing—from the rapid visualization of CAD models to photogrammetry and from vegetation models to simulated visitor behavior. Each of the subprojects defined by the APG contributes a single facet to a multipurpose model. The resulting application scenarios will be defined by a close cooperation among the APG and partners interested in putting novel scientific computing techniques to practical use.

Acknowledgements

The authors wish to thank the World Monuments Fund and the APSARA Authority for the invitation to and organization of the first Phnom Bakheng Workshop on Public Interpretation. Our gratitude also goes to all sponsors of the APG, in particular the Gottlieb Daimler- and Karl Benz-Foundation, Ladenburg, for the stipend of Pheakdey Nguonphan and the sponsorship of the Internet connection at RUFA, and UNESCO for supplying stipends for the visiting Cambodian students in autumn 2005.

A Commitment to Community Engagement

Khuon Khun-Neay, Department of Monuments and Archaeology 2, the APSARA Authority

The issue of integrating the local village communities in structuring heritage management is now a very prominent matter. We must see to it that the planning of the Angkor site, which is a living site, does not merely involve preserving monuments, but also considers the communities who live there. This living heritage approach involves the management of man and the environment, the intangible and the spiritual. The preservation of Phnom Bakheng as a living place goes beyond the conservation of its stone and brick structures to take into account the local people who use the site to ensure they can continue to practice their religious traditions and maintain an economic livelihood. This is truly a challenge for those of us who are planning specialists.

New approaches of the APSARA Authority

With the efforts of the Department of Monuments and Archaeology 2, the APSARA Authority is establishing a relationship with Angkor communities and beginning a new concentration on sustainable development. In 1995, the APSARA Authority was established to protect and conserve the World Heritage site of Angkor. The international community contributed to this protection with a two-phase program of work identified with the implementation of the APSARA Authority. The first phase, which began when Angkor was on the World Heritage in Danger List, aimed at fighting the looting of art objects, ensuring overall safety and security, and de-mining the site, for the safety of the local population and the visitors. During this time, the communities were sidelined from decision-making. Since 2004, APSARA has moved into its second phase of work, and the mission has changed. In addition to security and monument safety, the APSARA Authority has expanded its focus to embrace sustainable development, which includes working with the local population.

In response to the challenges of the second phase of the program, the APSARA Authority was restructured to include three new departments: the Department of Demography and Development, the Department of Water and Forestry, and the Department of Monuments and Archaeology 2. The Department of Demography and Development is responsible for economic and agricultural development. Director Tan Bounsuy, a specialist in agriculture, is now conducting research to find a means of using organic fertilizer to help the communities in the park improve their agricultural yield and introduce new crops. The intent is that communities could produce crops to sell to local hotels and thus improve their standard of living. The Department of Water and Forestry, led by Director Hang Peou, looks after

the forest resources and the water network of the region. The goals of this department are to make the sites more enjoyable and also to improve the everyday life of the Angkor region, since any new development cannot be separated from the water network or from the forest. The fact is that the forests and water resources are also inseparable from the monuments in the framework of Angkor.

Initiatives to benefit the local populations of Angkor

The Department of Monuments and Archaeology 2 was formed to improve the relationship with the communities within Angkor and to look after land use and habitats. The main responsibility of this department is land and community management in Zones 1 and 2 within the five protected zones that comprise Angkor Park. One of the first tasks of the second phase was to create a census of residents and villages in the area.

The population of Angkor has changed dramatically in recent years. Currently, there are 112 villages; many communities have existed in Angkor since ancient times and continue to live in the park today. Religious and economic traditions of the villages date from the time of the monuments' construction. To ensure that these populations can continue to live in accordance with their religious practices and customs, it is necessary to solicit the input of locals in making decisions for sustainable development and tourism in this region and to consider their values in plans for managing the social and natural environment.

The local population has benefited very little from the explosive tourism in Siem Reap. From an economic standpoint, 75 percent of money expended by tourists for trips to Angkor is spent outside of Cambodia. Of the remaining 25 percent, only about half reaches the communities directly. Looking ahead, it is important to hire people who live within Angkor so they too can realize the revenues of tourism. For example, the local communities must be able to grow vegetables and fruits that can supply nearby hotels. Knowing how people live enables planners to create means for local people to access the benefits of tourism.

In addition to economic issues, community values about how the park is used must be assessed. We have to go much further in understanding how people live in Angkor, as there are often a wide gaps among the standpoints of conservation technicians, the tourists, and the communities. Places that the community considers important for its uses are usually sacred places. Yet there are often sacred activities that tourists may want to see. A living heritage approach balances these values and provides opportunities for the local people to decide how they wish to continue their traditions, so that they may live their lives amid the new realities of tourism.

Conclusion

Through ongoing research and partnership with international projects, the APSARA Authority aims to care for the communities living within Angkor Park. This year we began a long-term project with the help of the University of Sydney and UNESCO called Living with Heritage. The program will last five years and concentrate on connecting conservation policy with the interaction between cultural heritage, society, and the natural environment. We also have a five-year project with New Zealand on planning management and community development, which will start next year.

Additionally, the World Monuments Fund (WMF) preservation project for Phnom Bakheng, under the auspices of the APSARA Authority, is taking steps to ensure that all who are involved, including the local communities, will benefit. The WMF has become aware of local population issues through their previous experience at the Preah Khan temple conservation project. During their work at Preah Khan, the WMF engaged and involved the surrounding villagers in maintaining the temple and allowed for a continued spiritual life. Now with the Phnom Bakheng project, the WMF has begun its work taking these various aspects of heritage into account: the condition of the monument, the landscape, and the people. Together we must involve the local community in this project in order to maintain the living qualities of this site.

The People of Angkor: Between Tradition and Development

Fabienne Luco, *École française d'Extrême-Orient* and Center for Khmer Studies

At the local level, Angkor is more than an archeological and tourist site; it is also a "living place." Thousands of people live there, tend to their rice fields, and practice religious cults according to their traditions. Remarkably, some of their gestures and practices appear to be very similar to some ancient scenes depicted in the bas-relief of the Bayon temple's south gallery. Until recently, life in the villages of Angkor did not differ much from other villages in Cambodia. Thus, the uniqueness of the villagers is that they are living in a place that since 1992 has been inscribed on the UNESCO World Heritage List and also a place that symbolizes Cambodian national identity. Regulations aiming to protect defined archeological zones have been promulgated, and a growing number of tourists choose Angkor as a cultural and leisure destination. These two factors combined have had a profound socioeconomic impact on the daily traditional activities of the people of Angkor.

For several decades, international debates have focused on the conservation of monumental heritage and the development of tourism on World Heritage sites. More recently, the discourse opened to a broader definition of heritage that comprises monumental and intangible heritage, meaning that living traditions should also be considered. UNESCO has introduced the concept of "living heritage site" to Angkor. Even if the concept of living heritage is not clearly defined, it is understood that the traditions of the local population could also be viewed as part of the World Heritage site, implying that the site of Angkor should be approached in a holistic way that would include monuments, environment, and population, and their dynamic evolution through space and time. Until now, little consideration has been given to the traditional knowledge of the local populations such as land, religious or social practices and representations. This knowledge is at present in danger of disappearance.

The modern transformation of the landscape and the socioeconomic life of the local population began decades ago, with the work of the *École française d'Extrême-Orient* (EFEO) and the beginning of tourism in the early twentieth century. Major changes in the daily life of the people of Angkor are still to come. New elements to be considered include sudden exposure to the outside world after years of war and isolation, rushed development, and the arrival of mass tourism, as well as rapid demographic growth of the local population.

Angkor has become a new place with complex and antagonistic debates among people representing different interests such as the restoration of temples, conservation, the tourism industry, heritage management, and local development, as well as governmental authorities and the local population.

The difficult equation is determining how to combine conservation of monuments, promotion of tourism, preservation of the environment, and development of rural areas while paying attention to traditional social and economic practices in one single place called Angkor.

Until recently, the local population had little voice in or access to the debates. They will, however, face important challenges in the future. First, they will have to adjust traditional ways of exploiting natural resources in accordance with international regulations and they will have to find alternatives to agriculture for new generations. Second, they will have to deal with demographic growth and devise measures for relocating new families outside core areas. Third, they will have to find a balance between preservation of traditions and rushed development based on imported models.

The World Monuments Fund (WMF) and the APSARA Authority have initiated a program of site assessment, planning, mobilization, and interpretation that takes into consideration the local communities living close to Phnom Bakheng.

This paper aims to recognize the linkages between the local communities and the Phnom Bakheng site in the face of global challenges such as development of tourism. It will pay particular attention to the practices and representations of the site by the local population from past to present.

1. The people of Angkor: Historical context

Ancient times

Data on the people of Angkor in ancient times are very limited. Inscriptions¹ give some details about the donations and delimitations of lands and lists of servants, but little is known about the daily life of the local population. The only direct description of Angkor comes from Tcheou Ta-Kuan,² a Chinese diplomat who traveled to Angkor at the end of the thirteenth century. He describes the capital city as populous and wealthy. His depictions cover daily life inside the town walls and in its immediate vicinity, from the royal court and members of various sects to the common people.

In the existing villages of Angkor, some older people today recall stories and legends of the past that lean on the very visible traces of the past construction, such as temples and dikes. These vestiges are used as support for the transmission as well as the creation of stories about a past that is represented as glorious. Concerning Phnom Bakheng, people tell the legend of a leper king who was reluctant to take an herbal bath that would cure him. They locate this story at the base of Phnom Bakheng in a place called the Changran Eysor ("pot of Civa"). They also tell legends of Angkor Wat and Prohm Kel temples. Angkor Thom inspires commentaries on

the great city, the gates, and the layout of canals where sampans were said to circulate.

Then, from the fall of Angkor in the fifteenth century until modern times, amnesia reigns. Aside from the royal chronicles,³ the accounts of a few foreign visitors and explorers,⁴ and fragments of what has been transmitted orally, little is known about local life during this period. According to oral tradition, the city was abandoned after its fall, and many people were deported to Siam. It is recalled that some groups of people were allowed to stay, while others were forced to leave. Later, some of these people are believed to have returned, joined by newcomers.

However, after being the site of intense activities of successive royal capitals, Angkor was not forgotten. Pilgrimage and Buddhist religious activities, including the construction of monasteries and offering of Buddha statues, continued in Angkor. Two monasteries still in use today were reported to have been active in Angkor Wat.

Modern times

Since the end of the nineteenth century, French explorers and researchers have paid special attention to Angkor. The EFEO in Cambodia was created in 1907. At that time, few data had been collected on the local population as researchers were more interested in the architecture, history, and epigraphy of the old temples. The EFEO embarked upon important restoration work, hiring "coolies" for the site restorations. By 1970, the EFEO was employing several hundred workers from the surrounding villages. The older people recall the great personalities of the EFEO, such as the conservators Henri Marchal and Bernard-Philippe Groslier.

In their journals and records, the explorers and researchers describe scattered villages of poor rice farmers with strong religious beliefs and active practices. These villagers survived on rice farming and fishing, and also on resin tapping and sugar-palm and bat-guano collection activities. Some researchers noted that the gestures of the local population resembled those depicted in scenes of the bas-reliefs, but, surprisingly, few took a significant interest in the local traditions.⁵

Thus, the French explorers and researchers drew some old maps and located villages, some of which still exist today. During their explorations of Indochina from 1866 to 1868, the French explorers Doudart de Lagrée and Francis Garnier came to Angkor and noted a few villages: Preadac, Siem Reap, Phok, as well as one village located inside Angkor Thom. In 1909, Lieutenant Buat, a geodesist, and Lieutenant Ducret, a topographer, established a more precise map of Angkor where one can identify the villages of Pradak, Rohal, Ampil, Tropeang Seh, Angkor Thom (Angkor Krau), Bakheng, Ta Chan, Kvien, Svay Romiet, and Bantey Chheu.

The beginning of tourism

Over the last hundred years, a new concept has emerged in Angkor: tourism. In 1907, 200 tourists, probably colonials from Phnom Penh or Saigon, were counted. But within decades, more and more tourists would come.

In the 1920s, in order to facilitate visitor access to the site, the government authorities, based on the recommendations of the EFEO, built the roads of the Small and Big Circuit and even a bungalow for overnight stays in front of Angkor Wat.

The first regulations and their implementation

Since the first drawing of regulations in Angkor in 1911, the definition of a protected area began to be debated.⁶ A decree dated 30 September 1929 stipulated that a "preserved zone" with specific regulations was to be created in Angkor. Villages located in the close vicinity of temples quickly came to be seen as disturbances. Villagers living inside the preserved zone were forbidden to build new houses, tap trees for resin, cut down trees, or clear new lands. Conversely, in order to control the expansion of the forest, rice farming was encouraged in the Western and Eastern barays as well as in the moats of Angkor Thom.

These regulations aiming to limit the expansion of villages, however, were rarely implemented, with the exception of the ancient villages located close to Angkor Wat and to Phnom Bakheng. In the 1960s these villages would move to new residential lands a few kilometers to the southwest. Nevertheless, the villagers would be authorized to practice agriculture on their old rice fields.

Local population memory

The memory of the present-day local population rarely goes beyond the grandparents' generation. The older people recall the events of recent history, especially the periods of insecurity and combat during repeated Siamese invasions, the fractious struggles of the anti-French Issarak movement, and the violent upheavals under the Khmer Rouge. These villagers also emphasize the displacement of villages specifically in the area of Angkor Thom, Angkor Wat, and Phnom Bakheng. From the oldest times, they relate stories of the Siamese raids and the subsequent exodus as well as displacements of villages during the French period. In one instance, Vietnamese monks were practicing Hinayana Buddhism in a monastery at the top of Phnom Bakheng. This religious community was relocated by the French.

The disruption

In 1970 the country was at war. Republican troops under Lon Nol launched attacks against the Viet Cong and Khmer Liberation Army or *Khmer Rumdha* (Khmer

Liberation). Fearing the bombings, the local population fled their homes and found refuge in the nearby temples in Angkor Thom and Angkor Wat. Lon Nol's troops controlled the area with machine guns installed at the summit of Phnom Bakheng. But in 1972 the Khmer Rouge took swift command of Angkor and displaced the local population to areas north of Angkor. Until 1979 the area was deserted, used only temporarily by mobile brigades, the *krom chalat*, for agriculture and sugar-palm exploitation. A few of the dikes of the old rice fields were destroyed and replaced by larger, square rice fields. It is worth noting that the Khmer Rouge took particular interest in Angkor as a symbol of national pride, and visitors from allied countries were invited to visit the site.

The reconstruction

At the end of the Pol Pot regime in 1979, the people of Angkor desired to return the land of their ancestors, to rebuild their houses, cultivate their rice fields, and live according to their traditions. The people who had been displaced in the 1960s came back to the old settlements close to Angkor Wat and to Phnom Bakheng. Yet insecurity prevailed and the fighting continued only a few kilometers away. In order to avoid conflicts over land ownership, the authorities ordered a redistribution of property. Each family would receive a new agricultural plot.

The country was then ruled by the Popular Republic of Kampuchea. This government lacked international recognition and was therefore under economic embargo. Cambodia would have wait until the early 1980s to reopen to the outside world.

2. The rapid opening to international regulations and mass tourism:

The present

The early 1990s marked a turning point for Cambodia. In 1992, Angkor was inscribed on the UNESCO World Heritage List, ensuring the protection and conservation of the historic site's architectural zones and landscapes. Then, in 1993, internationally recognized national elections resulted in opening Cambodia to an influx of international aid.

At Angkor, World Heritage designation brought with it regulations, as well as mass tourism and rapid development. These changes have produced new social and economic impacts on the local population.

The first governmental measure was to repeat historical displacements. People who had returned to their old settlements close to Angkor Wat and Phnom Bakheng after the Pol Pot regime were assigned parcels of residential land north of Siem Reap town in a large area called Phum Thmey ("new village"). However, the inhabitants maintained their former village names in the new location, and the families

still had the use of their old rice fields close to the temples. In the following years, the poorest sold the new residential land and little by little resettled in the old villages close to their rice fields. Within a short time, people were living around Phnom Bakheng in small houses or huts in the hamlets of Tropeang Seh, Bakheng, Tropeang Peuk Teuk, Teaksen, and Kok Dong. In fact, with little revenue and lacking true ownership of the land, these people are socially and economically very vulnerable.

The people of Angkor: A traditional society

The people of the Siem Reap region are known to be very conservative with respect to old traditions. Notably, several traditional practices continue to be performed here, such as the top-knot cutting ceremony for teenagers and the Robam Trot, a dance performed for the Khmer New Year. Many old symbols and figures can also be seen in religious rituals.

The local population, living in small family groups or scattered villages, are mainly involved in traditional subsistence agricultural activities. Each family owns and cultivates one or several small parcels of land for rice cultivation, not exceeding one hectare. The people depend on one crop per year with a low average yield, less than one ton per hectare.

To earn their living, the local population traditionally engages in secondary activities such as growing vegetables, fishing, and the fabrication of palm sugar. Until recently they also made use of products from the forest, such as resin, medicinal products, creepers, fruit, and firewood.

The people of Angkor live in traditional raised wooden houses. They practice their religious beliefs in private ceremonies at home and celebrate Buddhist festivals in numerous monasteries. Besides the two ancient monasteries of Angkor Wat, new monasteries were built inside Angkor Thom in the early 1990s, close to existing Buddha statues.

Distribution of the population in the Angkor landscape

The landscapes and the natural resources of Angkor make it a very good location for living. The numerous mounds, old dikes, and roads create excellent conditions for building houses on high lands, out of the reach of water during the rainy season yet very close to low lands used for rice cultivation. Moreover, fresh water is easily accessible from wells (a few meters underground) and abundant ponds.

Phnom Bakheng and the local communities

Tourists visiting Angkor's monuments might not see the scattered villages of

Angkor, overshadowed by the temples and shrouded in forest. While climbing up Phnom Bakheng temple for the sunset, however, they will discover a vast cultivated plain and groups of houses hidden among the fruit trees.

Trying to define a homogenous local community with specific links to Phnom Bakheng is rather difficult, depending on whether the classification is geographic, social, or economic. Several villages of rice farmers are scattered in geographic proximity to Phnom Bakheng. Socially, we could define two local communities: the people of Tropeang Seh and the people of Kok Chan, who define themselves as distinct social units sharing a common history, ancestors, and veneration of the same *neakta* (land spirits).

• *Tropeang Seh community, close to Phnom Bakheng and Angkor Wat*

The families of the old hamlets of Bakheng, Kok Dong, Teaksen, Tropeang Peuk Teuk, and Tropeang Seh claim tight links among one another. Locally, this community worships several *neakta*, of which the most important are the *neakta* Ta Kuang, living in a small hut east of Kok Dong village, and the *neakta* Ta Raj in Angkor Wat. Concerning Phnom Bakheng, the people evoke the *neakta* Ta Kas Krohom on the hilltop.

• *Kok Chan and Baray communities, west of Phnom Bakheng*

These communities assert close connections: Kok Ta Chan, Kok Beng, Kok Thnaot. The people of Kok Chan village worship several *neakta* of which the most important is Ta Kuang, located east of Kok Chan village. Another *neakta*, Ta Kuang, is living in a hut inside the village of Kok Beng. The people of Kok Thnaot worship a *neakta* called Mok Buon⁷ ("four faces"), as well as other minor ones.

• *Other communities, Angkor area*

Other villages in the Angkor area have links with Phnom Bakheng. These connections can be classified as economic. Thus, some of the vendors in front of the east entrance of Phnom Bakheng come from eastern villages such as Sras Srang and Rohal whose inhabitants are said to be more skilled in handicrafts and business.

These local communities, however, are not closed to outsiders and, to the contrary, are presently mixing more and more with each other. This commingling could be related to the development of local businesses linked with tourism, which attract young people from different places and facilitate their meeting.

It appears that the social and religious center of these communities is Angkor Wat, where people gather for Buddhist festivals in the two ancient monasteries. There, they worship the *neakta* Ta Raj, the great land spirit who controls and protects the whole Angkor area. On the top of Phnom Bakheng, one can find evidence of at least three active religious cults: the *neakta* Ta Kas Krohom, the Buddha footprint, and a

statue of Preah Ko. Nevertheless, it appears that the religious cults there are practiced more by tourists than by local people.

Angkor Thom is also considered a place of great importance. Current villagers recall that some of their ancestors lived and cultivated lands inside Angkor Thom. Moreover, until recently, the natural resources of the forest inside the city's fortifications were still being exploited.

From the rapid field survey that I did, it appears that Phnom Bakheng is part of a large social area that comprises Angkor Thom, Angkor Wat, and the baray zones. More fieldwork is needed to understand the interactions among the local communities within this specific area.

Introduction of new regulations

A royal decree (001/NS) "establishing protected cultural zones in the Siem Reap/Angkor Region" was signed by King Norodom Sihanouk in May 1994. The decree defines a perimeter of protection inside the Siem Reap region and four zones of protected sites, each one with specific regulations. The "Central Park" comprises Zone 1 and Zone 2.⁸ Phnom Bakheng is located in Zone 1.

- *Zone 1:* Monumental sites. This zone contains significant archeological sites and their surroundings. Some 30 villages comprising 40,000 people are located in Zone 1.
- *Zone 2:* Protected archeological reserves. This zone contains "areas rich in archeological remains which need to be protected from damaging land use practices and inappropriate development". This zone is larger than Zone 1 and contains 55 more villages.

Zone 1 and Zone 2 together cover an area of 401 square kilometers. Zone 1 and Zone 2 of the "Central Park" of Angkor contain a total population of 80,993. Other significant sites outside Central Park have been defined as Zone 1: Bantey Srei group and Roluos groups.

A year after the protected cultural zones were established, in February 1995, a second royal decree established APSARA, a national authority for the protection and the management of Angkor and the region of Siem Reap.⁹ Since its creation the APSARA Authority has gone through different phases. The first phase focused on protecting and restoring monuments. In the second phase, APSARA concentrated its efforts on tourism and is presently focusing on rural economic development.

In November 2004 the APSARA Authority debated the settlement of populations in Zone 1 and Zone 2 of the archeological site. It concluded that existing houses would remain but that new constructions would be forbidden.¹⁰ New alternatives must now be found for the housing and livelihood of future generations.

Living on a World Heritage site that is visited by thousands of tourists: Impacts on the local population

Regulations aiming to protect the monuments and landscape of Angkor and the development of tourism have and will have further social and economic impacts on the local population. Access to natural resources has been noticeably reduced; villagers have been displaced and denied or given limited access to new lands for housing. Some traditional activities have been abandoned, while a few new economic activities have emerged.

Access to natural resources reduced or denied

The traditional way of acquiring land was by plowing it. Until recently access to land was not a problem as there was a small population and plenty of land available. Since the promulgation of new regulations aimed at containing agricultural lands, there is a concern among the local population that future generations will not have access to arable land. In some areas close to temples, old rice fields had to be abandoned, reducing the income of many families. Regulations aimed at protecting the forest have led to prohibitions against collecting firewood and tapping for resin. Forced to buy firewood from outside, the local people have also abandoned the fabrication of palm sugar, which requires firewood for the boiling process, as it ceased to be profitable. Access to fishing resources has also been reduced with the prohibition against fishing in moats and ponds such as those at Angkor Wat and Sras Srang.

Displacement of villages, denied or limited access to new lands for housing

As mentioned earlier, in the early 1990s the villages located in the close proximity to Angkor Wat were moved again to southern lands. Many of the villagers have already sold their apportioned plots and returned to the lands of their ancestors. This situation, combined with the settlement of new people from other provinces, has created an anarchic land situation in the area west of Angkor Wat. In contrast, it is worth noting that in the old villages that were not relocated the land situation and demography is much more controlled and stable. Currently the old traditional villages present a potential for alternative tourism. The situation could change, however, as the trend is to build concrete houses, which are less costly and more modern than traditional wooden houses.

The APSARA Authority is now working on the development of new living sites for the younger generation. It has selected an area of 1,000 hectares in the area of Run Taek. Several projects there are currently being debated, such as promotion of rural credit, traditional architecture, and development of alternative activities such as making handicrafts, among others.

Development of new activities

The development of tourism and the reduction of traditional activities have led to a search for economic alternatives. The site-restoration agencies, the APSARA Authority, the Sokha Hotel company, as well as private companies employ a few thousand people as restoration workers, guards, or cleaning staff. Locals as well as people from other provinces have developed private small businesses, for example selling cold drinks, scarves, and locally made handicrafts in front of the temples. Some villages, namely Sras Srang and Rohal, produce wooden handicrafts such as small oxcarts, birds, knives, and axes. Unfortunately, businesses close to the temples are not well organized and tourists prefer to buy souvenirs at shops in Siem Reap town. As a result the craftsmen located on the tourist site sell more at lower prices to middlemen than directly to tourists.

In poor villages such as Bakheng and Kok Dong, young people feel they lack both the skills to make handicrafts and the money to buy goods to sell to tourists. Many of these young people are now employed as construction workers for hotels in Siem Reap. There is a fear that with their low level of education they might not be qualified to work in the tourism industry once hotel construction inevitably slows down. The most lucrative jobs related to tourism, such as moto driver, taxi driver, and tourist guide, most often go to urban people, who are more educated and have easier access to foreign language courses.

In the last few years, a UNV (United Nations Volunteers) team followed by the ADPO (Angkor Participatory Development Organization) and several non-governmental organizations have initiated participative development programs in several villages in Zone 1, such as diversification of agriculture (high-yield vegetables and rice), rural credit, a rice bank, public health, and access to water. These groups also have been active in the promotion of traditional activities such as handicrafts and dance. (For example, a traditional *trot* dance troupe has been created in Pradak village.)

But many of these programs have not met expectations; the community-oriented programs do not always conform to the social reality. Moreover, the rural population seems very permeable and vulnerable to the economic and cultural pressures that have resulted from rapid exposure to the outside world.

Fragility of the traditional culture confronting outside cultures

Traditional knowledge is disappearing with the accelerated opening of formerly conservative populations to the outside world. The thread of oral transmission had already been cut during the Khmer Rouge period and is now neglected by the younger generation. Televisions can be found in all villages and accelerate the loss of traditional culture.

Fragility of the local population facing economic pressure

The creation of new needs leads to the search for sources of significant income, some of them illegal. The looting of artifacts sadly is often perpetuated with the help of villagers who see it as a means of quick and considerable income. Such a practice was unthinkable before the war. The stones and artifacts had more sacred values than economic ones. Child prostitution for tourists within the Angkor area must also be mentioned as an emerging economic alternative, however pernicious.

Conclusion

While development is visible in the urban areas, it is less perceptible in the rural villages of Angkor. The APSARA Authority has begun to restore a dialogue with the local population by holding meetings and consultations in the villages. These efforts to involve the people of Angkor in the decision-making process are to be encouraged.

For the future it is highly desirable for national and international institutions to concentrate on rural development and to build, with the participation of the local populations, long-term development programs that integrate the preservation of local traditions.

Whereas architectural monuments are being preserved and stabilized, the intangible cultural heritage is undergoing rapid transformations. Rituals, social practices, and economic activities are not fixed. These intangible aspects of cultural heritage are more sensitive to homogenization and more difficult to protect against the uniformity of globalization. Attending to this difficult issue, as this workshop is doing, contributes to a better understanding of the dynamics of change and helps to prepare the local traditional population for the cultural transformations they face. Development cannot proceed in a sustainable manner unless the local communities are involved in the management of World Heritage sites. The pivotal role that communities play in the management of World Heritage sites must be recognized.

Recommendations

1. Recognize the outstanding linkages among people, the environment, and the monuments in a site listed on the World Heritage List.
2. Consider the importance of involving all the stakeholders, such as local communities, in the planning, management, and evaluation process.
3. Consider local culture and collect data on traditional knowledge regarding land tenure and water management, house building, social and religious practices, and legends and stories about the past.
4. Assess and understand the values given to Angkor and Phnom Bakheng by local

communities in order to involve those communities in the investigation and management of their pasts. Evaluate what they would like to see retained for future generations.

5. Promote alternative livelihood opportunities for the local communities.
6. Help to promote sustainable tourism in villages.
7. Promote environment-friendly industries.
8. Develop ecotourism so that the natural environment is considered.
9. Promote environmental education and information with the active involvement of children.
10. Give priority to development activities for the residents of the site (such as those outlined in Article 17 of the 1994 Royal decree).¹¹
11. Promote traditional construction.

Notes

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² Pelliot, Paul. 1951. *Mémoires sur les coutumes du Cambodge de Tcheou Tu-Kouan*, Paris, A. Maisonneuve.

³ Khin, Sok. 1988. *Chroniques royales du Cambodge (de 1417 à 1595)*, EFEO.
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⁴ Aymonier, Etienne. 1900-1904. *Le Cambodge*, Paris, Ernest Leroux, 3 vol.
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Ebihara, May. 1971. *Svay, a khmer village in Cambodia*, Michigan, Ann Arbor, University micro-films international, 2 T.

⁶ The Royal ordinance dated 31 March 1911 defines reserved perimeters for the “ruins of Angkor.” A zone of protection of 200 meters is identified around the most important monuments.

⁷ That could be identified as the Hindu god Brahma, represented with four faces.

⁸ APSARA, *The region of Siem Reap-angkor: villages and populations of the protected Zone 1 and Zone 2, Statistics in 1998 and 2002*, Department of culture and research, Apsara, 2003.

⁹ Autorité pour la Protection du Site et l’Aménagement de la Région Angkor.

¹⁰ Standards pour l’utilisation des sols dans les zones protégées 1 et 2, Décision du RGC no.70 SSR du 16 septembre 2004.

¹¹ Article 17 of the 1994 Royal decree says that “residents (of Zone 1) should be given priority for trading/permits concessions on the sites” and “assist the development of essential community facilities and encourage small scale-tourist facilities linked with village life.”



Fig. 1. Aerial view of Phnom Bakheng, 1963 (EFEO)

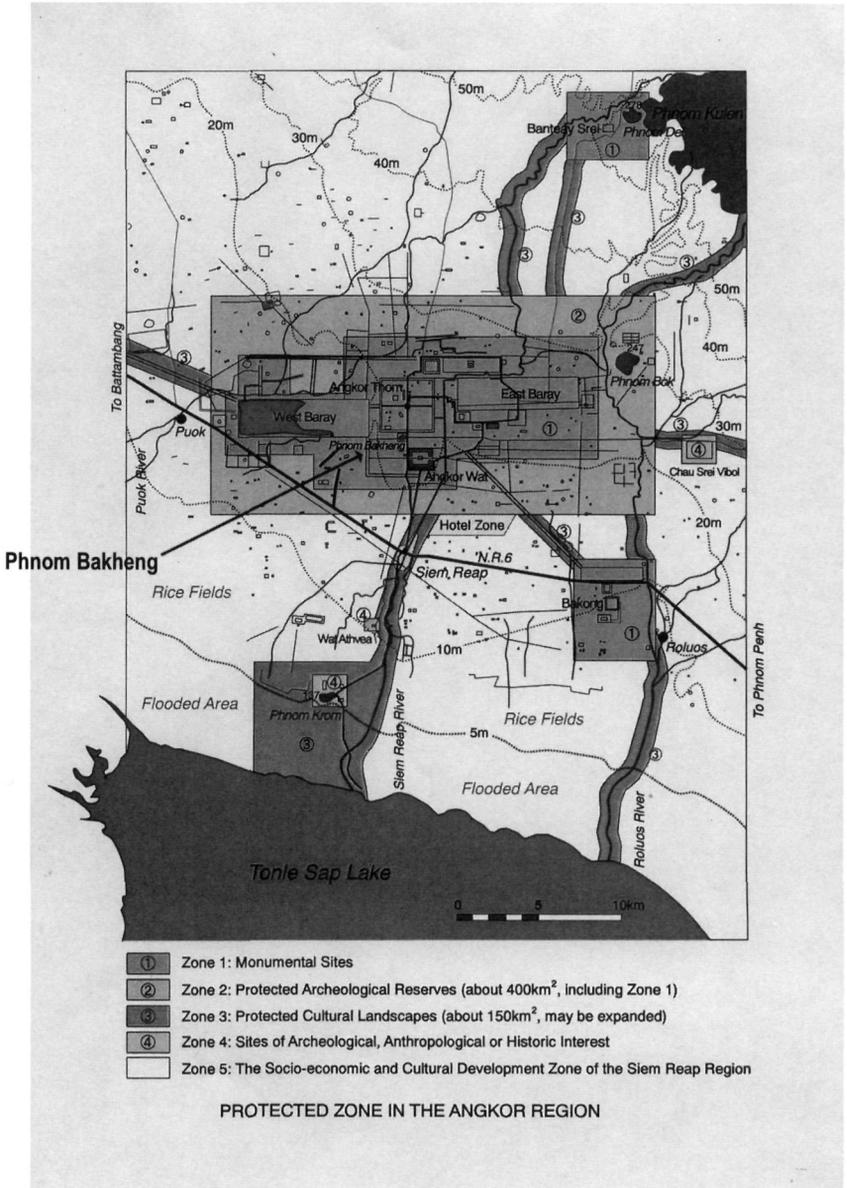


Fig. 2. Angkor zoning map, Zoning and Environmental Management Plan for the Angkor Area (ZEMP)



Fig. 3. Base of the sixteenth-century Buddha found on the summit, 1923 (EFEO)



Fig. 4. Repairs to the first terrace, 1956 (EFEO)



Fig. 5. Condition of the first and second terrace, 2003 (Dupuy)



Fig. 6. Tourist throng at sunset (WMF)



Fig. 7. Perilous descent by east stair (Winter)

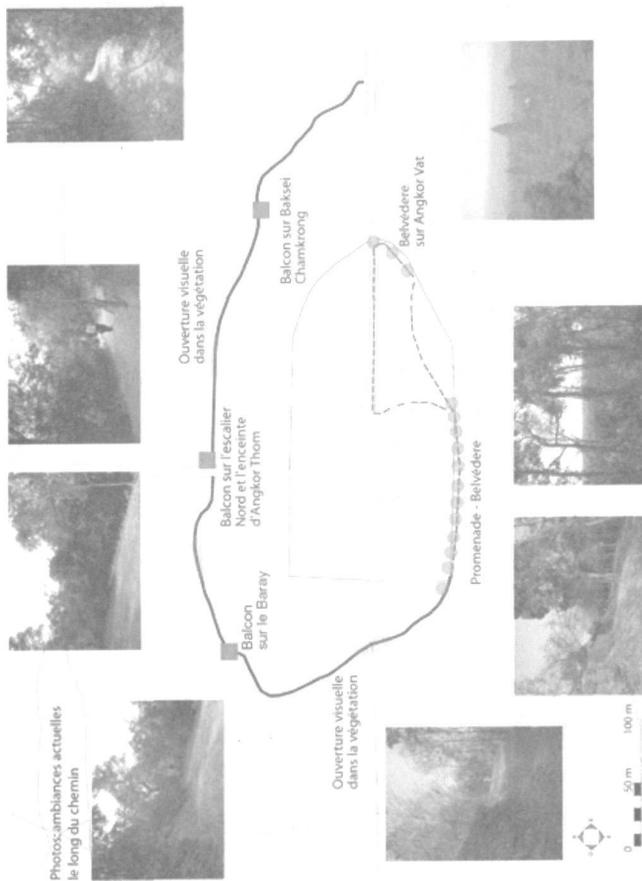


Fig. 8. Panoramic Trail and lookouts (Califano)



Fig. 9. House in Teaksen village, east of Phnom Bakheng (Gilmartin)



Fig. 10. Reforestation and management (Chermayeff)



Fig. 11. APSARA nursery (Hang)

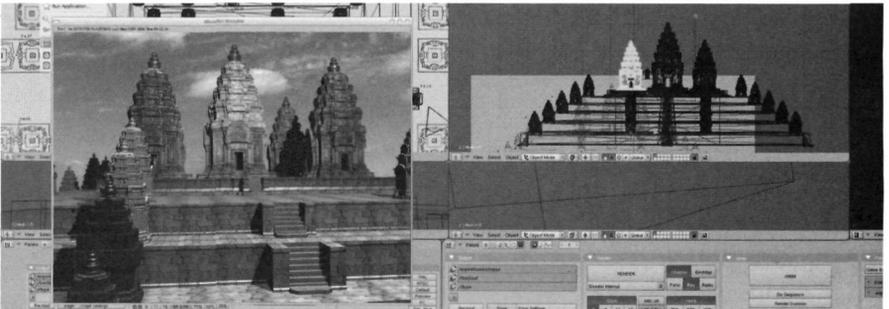


Fig. 12. Computer model of the monument (IWR, University of Heidelberg)



Fig. 13. Meeting of Phnom Bakheng community and religious representatives, 2006 (Gilmartin)



Fig. 14. Workshop site visit (Chermayeff)



Fig. 15. Workshop participants, Center for Khmer Studies, December 2005 (WMF)

Tourist Patterns at Phnom Bakheng

Chau Sun Kérya, Department of Angkor Tourism Development, the APSARA Authority

According to investigations completed in November 2004, it appears that 41% of the tourists coming to Angkor Park visited Phnom Bakheng, which is the eighth most visited temple in the park. Crowd-management problems at this temple stem not from its size—the site is not especially small—but rather from a very unequal hourly distribution. Indeed, all guides, whether people or books, direct visitors to Phnom Bakheng for its incomparable view at sunset. The effect is catastrophic.

A precise survey of tourist flux at Phnom Bakheng was therefore led by the Visitors Investigation Unit (VIU) of the Department of Tourist Development of Angkor (DTDA) of the Authority for the Protection and Management of Angkor and the Region of Siem Reap (APSARA). This survey was carried out in three phases: two weeks in November 2004, two weeks in December 2004, and one week in February 2005. These three months are the highest in terms of tourist frequency.

The VIU investigators used various quantitative measures (by time of visit, by nationality, and by path taken) and followed approximately 100 randomly selected tourist groups in order to reconstitute a zone map of visitors' stopping points.

The results given here concern the following points: General results; Group size; Visit time; Hourly distribution; Paths used for going uphill and downhill; Stairs of the temple; Conclusion.

I. General results

Most tourists frequenting Phnom Bakheng have sunset for a goal. Investigating the real interest of a visit "without sunset" deserves further study.

The following tables show the results recorded during the weeks of the survey, which are high-frequency visitation periods. It is necessary to note that it never rained during the survey periods.

1.1 Number of visitors

| | |
|------------------------------------|-------|
| Average number of visitors per day | 1,918 |
| Minimum | 1,058 |
| Maximum | 3,225 |

1.2 Distribution of nationalities

| | At Phnom Bakheng | At Angkor Park |
|--------------|------------------|----------------|
| Khmers | 16 % | 54 % |
| Other Asians | 48 % | 23 % |
| Westerners | 37 % | 23 % |

1.3 Participation in guided group tours

| | Without tour guide | With tour guide |
|--------------|---------------------------|------------------------|
| Khmers | 100 % | 0 % |
| Other Asians | 4 % | 96 % |
| Westerners | 46 % | 54 % |
| TOTAL | 35 % | 65 % |

Most visitors to Phnom Bakheng (65%) come with a tour guide; this proportion is 54% for western visitors and 0% for Khmers. Therefore, informing and educating tour guides is essential.

1.4 Visits at sunset

The end time of a visit indicates which visitors viewed the sunset.

| Visitors coming for sunset | Without tour guide | With tour guide | TOTAL |
|-----------------------------------|---------------------------|------------------------|--------------|
| Khmers | 30 % | ? | 30 % |
| Other Asians | 85 % | 99 % | 98 % |
| Westerners | 45 % | 99 % | 74 % |
| TOTAL | 41 % | 99 % | 79 % |

The table shows that 79% of the Phnom Bakheng visitors come to the monument for sunset; this proportion is 98% for the "other Asians" and 74% for the westerners. Nearly half (45%) of western visitors without tour guides come to Phnom Bakheng at sunset. Of Phnom Bakheng visitors without tour guides, 41% come at sunset, whereas 99% of visitors with tour guides come at sunset.

2. Size of groups

During the five weeks of the survey, VIU investigators followed Phnom Bakheng visitors coming in small groups of about six to eight people.

| | 1-4 pers. | 5-9 pers. | 10-14 pers. | 15-25 pers. | 25 pers. + | Average size of groups |
|--------------|------------------|------------------|--------------------|--------------------|-------------------|-------------------------------|
| Khmers | 9 % | 22 % | 14 % | 22 % | 34 % | 10.6 |
| Other Asians | 13 % | 17 % | 28 % | 24 % | 19 % | 8.4 |
| Westerners | 60 % | 14 % | 0 % | 0 % | 26 % | 3.2 |
| TOTAL | 26 % | 16 % | 18% | 17 % | 22 % | 6.8 |

The Khmer visitors to Phnom Bakheng tend to come in big groups; 34% among them visited in groups of 25 people or more.

| | 1-4 pers. | 5-9 pers. | 10-14 pers. | 15-25 pers. | 25 pers. + | Average size of groups |
|--------------------|------------------|------------------|--------------------|--------------------|-------------------|-------------------------------|
| Without tour guide | 52 % | 15 % | 7 % | 11 % | 17 % | 3.7 |
| With tour guide | 12 % | 17 % | 25 % | 22 % | 24 % | 8.4 |
| TOTAL | 26 % | 16 % | 18 % | 17 % | 22 % | 6.8 |

More than 50% of visitors without tour guides come in small groups of fewer than four people.

| | 1-4 pers. | 5-9 pers. | 10-14 pers. | 15-25 pers. | 25 pers.+ | Average size of groups |
|---------|-----------|-----------|-------------|-------------|-----------|------------------------|
| Daytime | 43 % | 28 % | 8 % | 0 % | 21 % | 3.6 |
| Sunset | 17 % | 14 % | 23 % | 23 % | 23 % | 7.8 |
| TOTAL | 26 % | 16 % | 18 % | 17 % | 22 % | 6.8 |

The daytime visitors, contrary to those at sunset, come in small groups: 3.6 people on average.

3. Visit times

The visit begins when the visitor arrives at the square at the base of Phnom Bakheng and concludes after they have descended and returned to their starting point.

3.1 Distribution of visit times by nationality

| | 0 to 30 min. | 30 min. to 1h | 1h to 1h30 min. | 1h30 min. + | Average visit time |
|--------------|--------------|---------------|-----------------|-------------|--------------------|
| Khmers | 34 % | 54 % | 12 % | 0 % | 39 minutes |
| Other Asians | 8 % | 67 % | 20 % | 5 % | 52 minutes |
| Westerners | 5 % | 60 % | 27 % | 8 % | 54 minutes |
| TOTAL | 12 % | 62 % | 21 % | 5 % | 51 minutes |

The survey found that 27% of westerners stay between 1 hour and 1.5 hours at Phnom Bakheng. The average stay is 54 minutes. For all visitors, the average visit time is 51 minutes. A guide's presence tends to concentrate the visit in the range of 30 minutes to 1 hour.

3.2 Distribution of visit times by time of day

| | 0 to 30 min. | 30 min. to 1h | 1h to 1h30 min. | 1h30 min. + | Average visit time |
|---------|--------------|---------------|-----------------|-------------|--------------------|
| Daytime | 33 % | 52 % | 15 % | 1 % | 0:40 |
| Sunset | 5 % | 67 % | 22 % | 6 % | 0:53 |
| TOTAL | 12 % | 62 % | 21 % | 5 % | 0:51 |

The shortest visits are in the daytime, not at sunset.

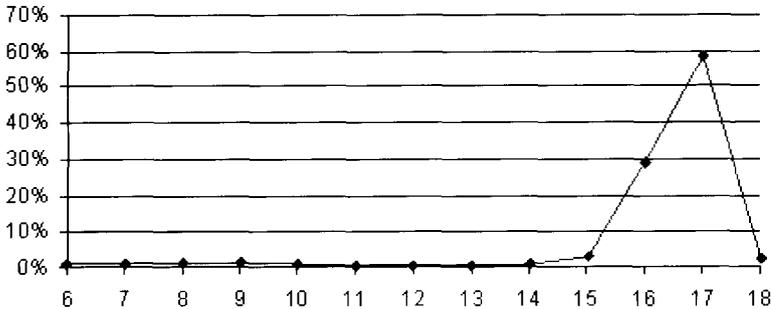
3.3 Distribution of visit times by group size

| | 0 to 30 min. | 30 min. to 1h | 1h to 1h30 min. | 1h30 min. + | Average visit time |
|------------------|--------------|---------------|-----------------|-------------|--------------------|
| 1 to 4 pers. | 6% | 51% | 31% | 12% | 1:00 |
| 5 to 9 pers. | 15% | 52% | 32% | 0% | 0:48 |
| 10 to 14 pers. | 0% | 81% | 19% | 0% | 0:48 |
| 15 to 25 pers. | 15% | 71% | 0% | 13% | 0:48 |
| 25 pers. or more | 18% | 64% | 19% | 0% | 0:49 |
| TOTAL | 12% | 62% | 21% | 5% | 0:51 |

Smaller groups stay 1 hour on average compared to 51 minutes for all visitors; the size of the groups does not seem to have a pronounced influence on average visit time.

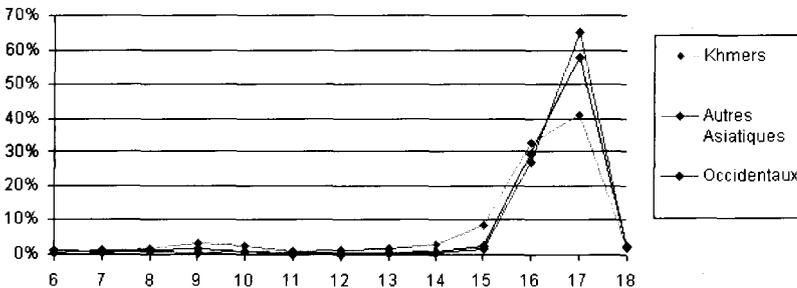
4. Hourly distribution

Hourly distribution of arrivals at Phnom Bakheng, based on survey outcomes:



Close to 60% of visitors arrive between 1700 and 1800, and 87% of visitors arrive after 1600; most of them stay until sunset. About 80% of visitors are present on Phnom Bakheng at the same time. There are, therefore, 1,500 people on average every evening for sunset. These visitors descend the hill at the same time within an interval of about 20 minutes. The crowd can reach 2,500 people when Phnom Bakheng is heavily frequented.

The arrival times are not the same according to nationality; however, visitation always peaks in the late afternoon.



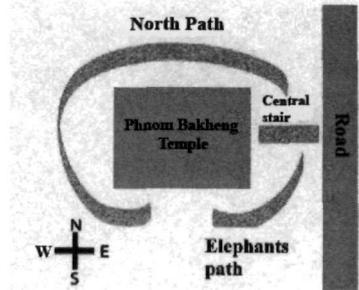
Visitors identified as "other Asians" rarely visit the site in the daytime; 94% arrive at Phnom Bakheng after 1600. This proportion is 90% for westerners and only 74% for Cambodians.

As mentioned above, "other Asian" tourists represent 48% of Phnom Bakheng's visitors, whereas they are in fact only 23% of the park's visitors. Thus Phnom Bakheng is a particularly valued destination for them, but solely for sunset.

5. Paths used for ascent and descent

Three paths exist to reach the summit of Phnom Bakheng

- the central stair: heavily used, direct path from the square to the temple, in very bad condition
- the North Path: deserted, encircles the hill, in very good condition
- the Elephants Path: used especially for descent on foot or by elephant, steep and dangerous when in use by elephants.



5.1 Distribution of ascent and descent by path, according to visitor nationality

| ASCENT | Central stair | North Path | Elephants Path, on foot | Elephants Path, by elephants |
|--------------|---------------|------------|-------------------------|------------------------------|
| Khmers | 92 % | 3 % | 3 % | 1 % |
| Other Asians | 92 % | 1 % | 2 % | 5 % |
| Westerners | 87 % | 3 % | 5 % | 5 % |
| TOTAL | 90 % | 2 % | 3 % | 5 % |

A total of only 2% of visitors use the North Path to ascend Phnom Bakheng, regardless of nationality.

| DESCENT | Central stair | North Path | Elephants Path, on foot | Elephants Path, by elephants |
|--------------|---------------|------------|-------------------------|------------------------------|
| Khmers | 72 % | 0 % | 27 % | 0 % |
| Other Asians | 73 % | 1 % | 24 % | 2 % |
| Westerners | 70 % | 1 % | 26 % | 3 % |
| TOTAL | 72 % | 1 % | 25 % | 2 % |

On the descent, 25% of visitors take the Elephants Path, whereas the North Path remains deserted.

Therefore, the central stair is more used on the ascent than the descent, as some visitors choose to descend by the Elephants Path, on foot. The Elephants Path is in fact used for coming down because some visitors first go southward to see the panorama and the view of Angkor Wat; they then perceive that there is a path, which is more apparent (and inviting) from the top than from below.

5.2 Average route times, on ascent and descent

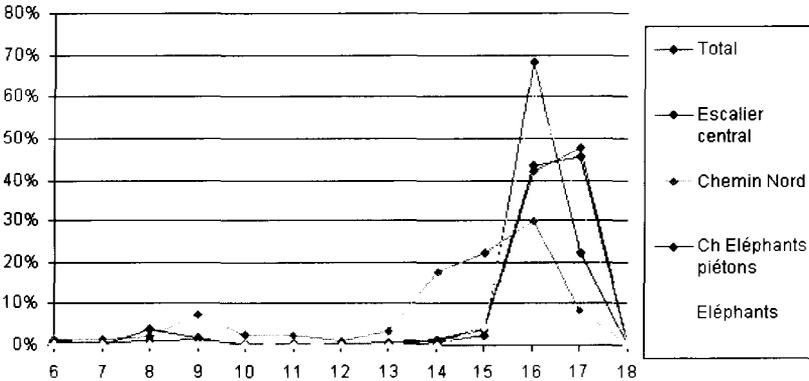
| ASCENT | Average time | Minimum | Maximum |
|-----------------------------|--------------|-----------|------------|
| Central stair | 5.58 min. | 3.16 min. | 21 min. |
| North Path | 13.39 min. | 8.02 min. | 22.37 min. |
| Elephants Path, on foot | 9.16 min. | 9.16 min. | 9.16 min. |
| Elephants Path, by elephant | ? | ? | ? |

The North Path is effectively longer; ascent by this route takes about two and a half times that of the central stair. However, the milder grade should prompt visitors to use it.

| DESCENT | Average time | Minimum | Maximum |
|------------------------------|--------------|------------|------------|
| Central stair | 5.48 min. | 3.02 min. | 11.07 min. |
| North Path | 11.42 min. | 10.23 min. | 13 min. |
| Elephants Path, on foot | 11.06 min. | 7.50 min. | 13.10 min. |
| Elephants Path, by elephants | 10.15 min. | 10.15 min. | 10.15 min. |

The descent times are more or less similar to the ascent times despite the crowds present just after sunset.

Hourly distribution of arrivals according to the ascent path is as follows:



The global curve presents hourly distribution between 1600 and 1700, contrary to the curve in section 4, as the survey of ascent paths was conducted in November, a period in which the sunset is especially early (between 1730 and 1800).

The North Path is therefore by far the flattest curve, indicating that the users of this path do not come specifically for sunset.

It is necessary to note that at 1700, there are so many visitors at the summit that the North Path is nearly impossible to see if one does not look for it; people in the middle of the crowd tend not to watch for other paths. By contrast, during the day visitors often stop at the informational panels (located below and to the right of the central stair, next to the departure point of the North Path) and then choose which path to take.

6. Stairs of the temple

Schematically, Phnom Bakheng is a temple-mountain in the shape of a square. The attraction for almost all visitors is the view from the temple's summit, which can be accessed by four stairways, each located in the middle of one of the temple's four faces.

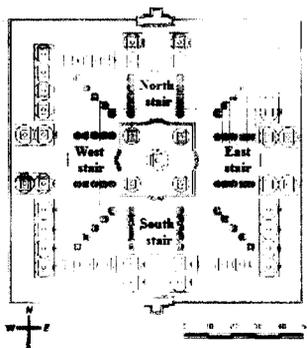
6.1 Distribution of ascent and descent by stair

Specific visitor counts for each stairway have been made.

| STAIR | Visitors ascending | Visitors descending |
|-------|--------------------|---------------------|
| EAST | 77 % | 60 % |
| NORTH | 1 % | 1 % |
| WEST | 1 % | 5 % |
| SOUTH | 21 % | 33 % |

Most visitors arrive by the central stair (see the diagram in section 5, above) and therefore naturally go up to the summit by the east stair, as this stair is in the best condition. For coming down, visitors are less attracted by the stair that is anyway impassable for descent at sunset: close to 900 people descend by this stair in less than 20 minutes.

6.2 Temple diagram, ascent and descent times



| STAIR | Avg. ascent time | Maximum | Minimum |
|-------|------------------|----------|----------|
| EAST | 1.43 min | 4.11 min | 34 sec |
| NORTH | 1.28 min | 1.35 min | 1.05 min |
| WEST | 1 min | 1.02 min | 58 sec |
| SOUTH | 2.24 min | 3.31 min | 1 min |

| STAIR | Avg. descent time | Maximum | Minimum |
|-------|-------------------|----------|----------|
| EAST | 2.17 min | 5.42 min | 40 sec |
| NORTH | 1.22 min | 1.40 min | 1.10 min |
| WEST | 2.35 min | 3.12 min | 1.08 min |
| SOUTH | 2.48 min | 6.12 min | 55 sec |

On descent, people sometimes become trapped in crowds in the middle of the stairs. This disquieting situation can last several minutes.

Remarks:

The visitor study permitted investigators to discover several interesting phenomena.

- Many visitors (about 40%) do not go up by an actual stairway: Those who go up by the east stair or south stair often in fact climb crumbling stones in a southeasterly direction to reach the first level, then join one of the two stairs to finish their ascent. Actually, this can be explained by the fact that the stiffness of the first portion of stairs combined to the trail draws the crowd in the direction of this crumbling.
- Similarly, on the descent, nearly 80% of visitors come down by the south stair, turn before the last portion of stairs, and head to the left until they reach the crumbling stones along the southeast angle. (In fact, there are two crumbling sections along this angle, one facing south and the other facing east.)

7. Conclusion

Review of main survey results

- More than 3,000 people can visit to Phnom Bakheng on the same day.
- About 80% of them come for sunset; therefore, 2,400 come down from the temple during a period of about twenty minutes after sunset.
- These are mainly the Asian, non-Cambodian visitors.
- The visits (departure from the square at the base and return to the same square) last about 51 minutes on average.
- For the ascent, the central stair is used almost exclusively.
- For the descent, usage is more balanced as some visitors choose the Elephants Path.
- Visitors stop 2.2 times on average, mainly at the foot of the temple and in the most elevated zones of the monument.

Remarks

During the daytime, a majority of visitors stops in front of the explanatory panels at the bottom of the hill. Some of them decide then to go up by the North Path. As the site becomes more crowded, visitors tend not to see the panels and instead follow the general movement to the summit.

During our study of tourists we saw the effects of tree pruning in the zone to the left at the top of the central stair: no one stopped there in November 2004, whereas about 40 people were present every evening shortly after five o'clock in February, resting and taking photographs. The tree pruning along the North Path, however, does not seem to have had the same effect.

Having gone up once on the *phnom*, visitors must do the ascension of the temple again. Then, visitors spread everywhere: they go toward the collapsing stones along the southeasterly angle, continue up to the first level by walking on the crumbling surface, then choose the south or east stair and finish the ascent. The same phenomenon could be observed on the descent.

Issues for site interpretation

Note: We must consider the "site" and not the monument.

1. Most visitors to Phnom Bakheng come for the sunset, not for the monument itself.
2. Recommendations for possible public interpretation of the site
 - Require paid ticketing for sunset viewing from Phnom Bakheng.
 - Promote sunrise viewing.
 - Direct tourist traffic to other panoramic sites.
 - When the parking lot is full, close access to the monument.

- Set up booking for groups and forecast a small margin for uninformed, last-minute visitors.
- Establish new pricing by pole of visits, separating the Phnom Bakheng visit from the Angkor Wat visit.

3. Suggestions for site planning

- Establish stopping points along the paths where there are panoramic views or photographic opportunities.
- Reduce the number of available amenities, which can attract more people, contrary to site-planning goals.
- Set up amenities that encourage people to spend less time at the site.
- Take into account crowd distribution flux in the planning.
- Find ways to lengthen the duration of visits to Phnom Bakheng by one-day visitors to avoid overcrowding at peak visitation times.
- For the future: when the infrastructure of the square in front of Angkor Wat is finished, close off all vehicular access to Phnom Bakheng from Angkor Wat.
- Take into account the national public behavior: too many perceived constraints could dissuade visitation.
- Organize attractions for the low season to encourage the national visitors and travelers preferring less frequented periods.

Bakheng Tourism: Setting New Standards for Angkor

Tim Winter, Asia Research Institute, Singapore

The sun always sets in the west

Standing at the bottom of Phnom Bakheng's eastern staircase—the main point of entry for visitors today—one cannot fail to notice the major erosion which is now occurring. Indicative of the threat facing the site as a whole, this staircase has been transformed in a few short years by one force in particular: tourism. And quite simply, tourism will continue to be the pivotal factor defining how successful efforts to preserve, protect, and restore will be in the future. In response, this brief paper suggests that a detailed understanding of the tourism industry must be at the heart of a heritage management and interpretation framework for the site.

The following pages call for a more rigorous understanding of both the tourism industry and the nature of tourist consumption in the Angkor–Siem Reap region. We need to develop better accounts of the multiple ways in which the site is valued by visitors traveling from a variety of countries, including of course Cambodia itself. It is highly likely that the introduction of site interpretation will only further increase the number of daily visitors to the site. If we are to develop policies capable of alleviating this ongoing pressure, we also need to comprehend the economic, social, and institutional forces that shape current patterns and rhythms of consumption.

Phnom Bakheng is suffering rapid damage not because of its architectural beauty or magnificence, but because of its prime hilltop location for watching the setting sun, an experience described by countless travel brochures as “the ideal way to end your trip to Angkor.” In this respect, this hilltop site parallels Mount Fuji in Japan, Uluru in Australia, or Mount Kinabalu in Malaysia, in that tourism at these landscapes is consistently shaped by the desires of visitors to catch either a rising or a setting sun. The challenges facing Phnom Bakheng today demand that we move beyond ideas of the site as a *phnom* understood in religious or cosmological terms toward an account that addresses the significance of this hilltop location within contemporary tourism. Indeed an approach that fully grasps such touristic processes is urgently required if Phnom Bakheng is to be preserved for Cambodia's future generations.

Bakheng as space: Moving from the architectural to the social

In essence the impetus for a management program for Phnom Bakheng has stemmed from ever-increasing levels of tourism, both domestic and international. Identifying the rapid changes currently occurring at the site, the International

Coordinating Committee for the Safeguarding and Development of the Historic Site of Angkor (ICC) has described it as the “most threatened temple in Angkor.” Diagnosing the nature of this threat is crucial, therefore, as is developing a strategy to reverse the current destructive trends. In order to better achieve these goals I would suggest that a shift in how Phnom Bakheng is conceived as a space would be beneficial. Within the framework of the Zoning and Environmental Management Plan (ZEMP) and the ICC, sites like Phnom Bakheng have been seen predominantly as physical landscapes and as static geographical spaces. To meet the challenges of tourism, however, this needs to be complemented, or perhaps even replaced, by a framework that situates the site within a broader social landscape conceptualized in terms of networks and flows.

It is widely known that Phnom Bakheng suffers from a distinct pattern of tourism, whereby 80 to 90 percent of visitors arrive to capture the last moments of daylight, a situation that leaves the site empty for most daylight hours. More research needs to be undertaken into the processes and forces that create these extreme peaks and troughs. At the heart of this approach would be an appreciation of how Phnom Bakheng sits within a broader network of tourism.

Understanding these connections would focus attention on the ways in which the site is locked within tourist itineraries that must include visits to the region’s key highlights, such as Angkor Wat, the Bayon, Preah Khan, and Ta Prohm. In order to fully appreciate why Phnom Bakheng is eroding and deteriorating faster than any other site within the Angkor Park, however, attention also needs to be given to a range of seemingly less-connected forces, whether they be local or geographically distant. These might include the influence of souvenir shopping and dining schedules along Route 6, recommended routes in guidebooks, ticketing polices, or the role played by airline schedules and travel itineraries composed in offices in Shanghai, Tokyo, Paris, or Singapore. While this might seem an ambitious agenda to pursue, the logistics of approaching this problem will be addressed below.

In the meantime, I want to illustrate this point further by briefly considering two specific examples. Firstly, all group, or “package,” tours to Angkor today include—without fail—a trip to a souvenir shop in Siem Reap. Typically part of the return journey to the guest house or hotel, and often scheduled for just after a sunset visit to Phnom Bakheng, these stops have become a defining feature of the daily rhythms of Siem Reap’s tourism industry. With the average length of stay having now settled around the two-day mark, tour guides have sought to maximize their commissions within these shops.

Secondly, Japanese tour operators are commonly expected to provide their clients with at least one sunset view during the course of a visit. Any deviation from pro-

grams that promise such highlights risks customers' submitting claims for compensation or reimbursement. Bearing in mind that these itineraries are written more than one year in advance, we can see that Phnom Bakheng forms part of an international tourism industry built upon a structural rigidity designed to deliver both reliability and predictability.

These two very brief examples form part of a complex network of local, national, and international forces that has arisen during more than a decade of rampant tourism growth. If we are to successfully address and appropriately redirect these forces in the future, it is imperative that Phnom Bakheng be analytically situated within this broader social landscape.

Understanding the tourist as consumer: From the universal to the particular

Past discussions of tourism policies proposed for Angkor often focused on ideas of promoting a "cultural tourism" industry. In essence, a language of cultural tourism reflects a desire to maximize the economic gains of tourism while simultaneously reducing the detrimental impact of the industry; understandably, it attempts to minimize the negative impacts of a more pernicious "mass tourism," and in so doing sets out to introduce "high quality" facilities. Within this framework an ideal visitor has been identified: the cultural tourist. Who is this cultural tourist? What are his or her physical characteristics? Does this tourist stay in certain hotels, read certain books, eat certain foods, or, indeed, spend certain amounts of money? In posing these questions, I would suggest that the cultural tourist is an idealized prototype with no empirical reality.

Crucially, policies that rely upon such an idealized prototype obscure the multiple and complex ways in which Angkor is being consumed as a heritage and tourism landscape today. As numerous academic and policy studies on sites like Stonehenge, the Acropolis, the Dome of the Rock, or Uluru have revealed, heritage landscapes are places where multiple meanings and values converge and coexist, sometimes harmoniously, sometimes in real tension [Bender 1999; Yalouri 2001; Tilley 1994; Smith 2004]. As these authors illustrate, heritage and tourism landscapes can never be reduced to one sole, definitive meaning. Such a realization has major implications for site presentation and interpretation. Rather than presenting the "historical facts" of Phnom Bakheng to an idealized cultural tourist, greater attention needs to be given to the diverse range of visitors to the site and the values they attribute to it.

For a number of reasons—the detailing of which lies beyond the scope of this short paper—policies for Angkor have been largely underpinned by a western-centric

understanding of tourism. As a consequence, the idealized cultural tourist has been implicitly constructed in European, *cum* western, terms. Significantly, however, such understandings and models have been uncritically applied to all tourists and forms of tourism. The current situation at Phnom Bakheng makes this situation untenable for the future.

Over the last five to ten years, the number of Asian tourists arriving in Cambodia has grown extremely rapidly. Tourism at Angkor is no longer dominated by visitors from France, the United States, or the United Kingdom. Rather, the statistics are now shaped by the influx of visitors from China, Japan, Korea, Taiwan, and ASEAN countries, most notably Thailand. A more comprehensive appreciation of how sites like Phnom Bakheng are made meaningful and valued by visitors from these various countries is urgently required. For example, Han [2004] and Nyíri [2006] have both recently demonstrated how Chinese readings of cultural and natural heritage landscapes significantly differ from western conventions.

The idea of collective memory further illustrates this point's relevance to Angkor. One of the most prevalent themes within Angkorian tourism today is the notion of discovery and exploration. Although commonly recognized as historically simplistic, the story of Angkor as a lost civilization rediscovered by the botanist Henri Mouhot in 1860 continues to shape the touristic encounter today. Reproduced in guidebooks, themed hotels and restaurants, this account privileges a Eurocentric understanding of Cambodian history. The associated idea that Angkor remained buried in the jungle for over five hundred years erases both local and more Pan-Asian histories.

Instead of reproducing a Eurocentric account of jungle discovery and subsequent restoration that caters to nostalgia for a golden era of European travel, the interpretation of sites like Phnom Bakheng needs to be oriented toward Asian audiences. Situating the site in its Pan-Asian historical, religious, and cultural contexts is one example of how this can be achieved. In her excellent article "Pilgrims to Angkor: A Buddhist 'Cosmopolis' in Southeast Asia?" Thompson [2004] provides evidence of a detailed and rich history of Asian travel to Angkor spanning several centuries. A similar theme has also been pursued by Edwards [2006] in her study of twentieth-century "graffiti" at Angkor, an account that foregrounds such texts to call our attention to previously ignored vernacular cultures and histories. Together these studies provide valuable signposts for a more holistic understanding of Angkor's landscape.

Particular attention needs to be given to how the site should be interpreted for visitors from across Cambodia. Far too often Cambodians have been ignored in the management and presentation of Angkor. The strategic development of Bakheng

offers an opportunity to redress this imbalance. To this end, a more detailed understanding is required concerning how Phnom Bakheng is used as a leisure space, as an active religious site, as a place for local community formation, and as a space of national heritage. Rather than remaining at the margins of policy, such knowledge needs to be at the heart of Phnom Bakheng's ongoing development and management.

Defining new paths of excellence

In the above two sections a number of challenges and agendas have been identified. Together they call for a better understanding of the cultural, social, and economic dynamics of tourism. This joint project of the Authority for the Protection and Management of Angkor and the Region of Siem Reap (APSARA) and the World Monuments Fund (WMF) has identified a clear set of problems, and this paper suggests that moving from a phase of diagnoses to solutions requires a sophisticated account of how Angkor is both produced and consumed as a tourism landscape.

In the first instance, both conservation and site interpretation need to reflect the diversity of Phnom Bakheng's audience. Phnom Bakheng and Angkor are first and foremost Asian heritage landscapes, and they need to be preserved, presented, and managed with that in mind. This means that—far more than merely presenting information in a variety of Asian languages—heritage policy should be informed by insights gained from frameworks like the Nara Declaration and recent studies of other heritage sites within the region. In more concrete terms it is recommended that a program of research be conducted within the three-year funding schedule that ascertains how Phnom Bakheng should be presented to, and made meaningful for, Cambodian and broader Asian audiences. Semi-structured interviews, focus groups, and comparative case studies are examples of strategies that can be adopted here. This knowledge can then guide answers to questions around historical continuity, artistic and religious significance, or the importance of Bakheng as a contemporary “living” site. The rapid growth of Asian tourism, both domestic and intra-regional, poses new challenges for heritage policymakers across the region today, and this APSARA-WMF project for Phnom Bakheng can provide a model of excellence from which others will learn.

By adopting a strategy that demonstrates how the Siem Reap tourism industry is directly impacting Angkor's key monuments, the WMF and APSARA will also present the ICC community with a radically new approach to site management. The problems at Phnom Bakheng exemplify why heritage management and tourism need to be seen and tackled as *one single entity*. The only way sites like Phnom Bakheng are going to survive over the long term is if current patterns of consump-

tion change (see fig. 6 and 7 in folio). Undoubtedly this is no easy task and will not happen overnight, but my own research has demonstrated that a will and enthusiasm exists within the private sector to improve the current situation.

To date, heritage policies have been directed toward resisting and deflecting the commercial sector in Siem Reap. As an alternative, I would suggest that a working group engaged directly with this sector be established. In attempting to relieve the pressure on Phnom Bakheng, one natural theme to pursue would be the development of alternative sunset sites, both within and beyond Angkor Park. To achieve such goals, the first step would be to identify key stakeholders within the tourism industry such as tour operators, travels agents, taxi drivers, tour guides, and the Siem Reap Hotel Association. Periodic meetings and a variety of publications could then share and disseminate knowledge across this community. Given the "copycat" nature of the Siem Reap tourism industry, even a small-scale venture involving a limited number of participants will snowball over time to deliver significant results. The major dangers facing Phnom Bakheng need to be presented as a collective problem in which the private sector is consulted and encouraged to become a partner in resolution. Only when various industry perspectives are shared, understood, and incorporated into policies can realistic alternatives that reduce the intense pressure on Phnom Bakheng be realized. There is little doubt that developing such a strategy poses major challenges in itself, and implementation will be far from easy. But a model of communication and proactive collaboration is the only sustainable solution for protecting Phnom Bakheng and other sites around Angkor for the long term.

The Conservation Master Plan for Phnom Bakheng

Michael Ellis, WMF Consultant

The Conservation Master Plan (CMP) for Phnom Bakheng, a temple-mountain within the World Heritage site of Angkor, is a document that states why this place is significant and how that significance is to be retained in the long term. The World Monuments Fund (WMF) is preparing this document in partnership with the APSARA Authority and key stakeholders as part of the Phnom Bakheng Conservation and Presentation Project.

This CMP incorporates a logical development progressing from the understanding of the history and fabric of the site to an explicit assessment of the significance, and from there directly to the formulation of policies for retaining that significance. The CMP examines the current setting and situation in a multifaceted way, taking into account Angkor Park and its geographical setting, climate, geology and topography, ecology, tourism, and current uses and facilities at Phnom Bakheng.

Assessing these aspects of the site provides a more complete understanding of the landscape setting and how its context has influenced the development of the site and its users.

The content of the CMP should undergo a transformation following the exchange of information among the scholars at the Phnom Bakheng Workshop on Public Interpretation. Their presentations covered all known relevant information about the site and its values, and the gathering served as a peer group occasion for presenting and integrating new information into the draft CMP. Following the review process and the completion of the CMP, companion documents will set out detailed action steps for the implementation of the proposals and policies for the site.

The WMF Project at Phnom Bakheng

To date, the WMF has conducted several missions with field experts and technicians as part of a three-year program that includes, in the first phase, detailed site assessment, conservation planning, emergency interventions, and site interpretation. These missions will further the development of the CMP. A brief overview of the planning, investigation, and emergency stabilization works that have taken place over the last twelve months sheds light on many of the areas of analysis that will be included in the CMP.

Mission I, a scoping mission, took place in December 2004. Procedurally the CMP was framed by producing a Project Identification Report, which resulted from this on-site integrated and holistic planning analysis. The WMF's signature charrette method for international heritage conservation project planning was used here due

to the severe time constraints posed by a number of urgent site and public safety issues at Phnom Bakheng.

This mission resulted in an initial determination of the optimum parameters for conserving and presenting Phnom Bakheng, which was arrived at by consensus with the project planning team and invited respondents. The findings were reported at an on-site presentation to the APSARA Authority and the International Coordinating Committee (ICC) Ad Hoc Group of Experts on 16 December 2004. WMF made a PowerPoint presentation on 17 December 2004 at the ICC meeting outlining its plans for the Phnom Bakheng Project. The ICC Ad Hoc Group endorsed the project being undertaken in partnership with the APSARA Authority at Phnom Bakheng.

Mission II took place between 14 and 31 March 2005. The main objectives of the mission were to further, in part, the investigations and proposals presented at the 17 December 2004 ICC meeting, to complete the Structural Risk Map, and to commence the emergency stabilization works. The APSARA Authority's concerns regarding the problems of storm water drainage were also addressed and the WMF engineers in collaboration with the APSARA Authority carried out a preliminary study.

Mission III took place between 29 May and 9 June 2005, which coincided with the ICC Technical Committee Meeting. The outcomes of Mission III included the advancement of the project planning, interpretation planning, vegetation management, and emergency stabilization. A hydrologist from U.S. National Park Service provided a hydrological survey assessment report and the engineers completed the Emergency Risk Mapping.

Future missions will further shape the CMP by providing additional assessment in the areas of tourism management, geology, and hydrology at Phnom Bakheng.

Initial Findings: Establishing Methodology

The initial study included surveying and mapping significant elements of the natural and cultural landscape that contribute to the character of Phnom Bakheng, including topography, moats, individual and copses of trees, habitat value, trails, agricultural patterns, living heritage, and views and vistas to and from Phnom Bakheng.

This cultural landscape analysis explicitly recognizes the history of a place and its cultural traditions in addition to its ecological value. Cultural landscape analysis is particularly useful when looking at the cultural landscape of Angkor, which generally contains a range of built structures within a modified landscape.

Phnom Bakheng, the first Angkor city, has been assessed as a cultural landscape rather than just considering the temple-mountain and its immediate curtilage. In

both the historical outline and in the physical survey, currently underway by the WMF and consultants, the broader context is being considered. By articulating and understanding the complex and interrelated values represented through cultural landscape assessment, a richer and more effective process for identification and management of Phnom Bakheng will be conceived. This approach encourages the understanding of heritage as an integrated system of related parts, in which the relationship between the parts acquires greater importance than the parts themselves. The cultural significance of Phnom Bakheng is currently not readily apparent to visitors; interpretation will enhance enjoyment and understanding of what makes this place monumental.

Phnom Bakheng provides an outstanding example of (and vantage point for) looking beyond the ensemble of buildings and seeing an entire landscape that is based on religious observance, Hinduism in this case, yet simultaneously expresses religiosity. The significance of Phnom Bakheng and the greater Angkor Park complex derives not only from aesthetic and symbolic value but also from achievements in civil engineering, especially hydraulics.

The originality of the hydraulic system of Angkor, and by extension Phnom Bakheng, is incontestable and is an integral part of the religious landscape. The remarkable arrangement of space marked out by the canals, and fed by the *barays*, would alone merit consideration for inclusion as a cultural landscape on the World Heritage List. Although the water harvesting system has a functional aspect, not to be underestimated is the religious significance of the water in the context of setting and ultimately spatial planning, which is balanced masterfully through building masses, landscape elements, and open space.

It follows that views and vistas to and from Phnom Bakheng are major elements that must be considered for retaining and conserving the cultural landscape of Angkor. It is important that these views are taken into account in the design of any development at the park with an actual or potential visual relationship with the temple-mount.

Management and Conservation Policy

Another aspect of the CMP development is the formulation of a management and conservation policy. The management planning process is based on a holistic, value-based, interdisciplinary, and participatory approach. It includes the assessment of site values, an assessment and documentation of its condition, study and analysis of the regional context, an establishment of guiding principles, and an identification of objectives and definition of strategies required to fulfill them.

Site conservation planning is focused on preserving and protecting the outstanding universal value of Phnom Bakheng within the context of Angkor, while enabling consensus-building with key stakeholders and realizing economic development in harmony with the site's aesthetic beauty and historic and cultural values.

Conservation in the context of this plan includes not only ensuring the physical survival of the archaeological site and monument, but also enhancing the visual character of the landscape setting and improving the interpretation and understanding of the whole site as a cultural landscape to visitors.

WMF policy is to carry out minimum conservation work necessary for the long-term survival and, where possible, display of the site. Any decisions on what should be done at Phnom Bakheng will be derived from a thorough understanding of the site and its significance and values.

WMF's approach to conserving the architectural remains of Phnom Bakheng will be to conserve it as a partial ruin. The general aim will be to slow or arrest the process of decay while also making the site safer and more intelligible to the visitor.

Conclusion

With the input of stakeholders, who include partners, scholars, and relevant communities, the Conservation Master Plan for Phnom Bakheng serves as a working tool for the APSARA Authority and the WMF to communicate the significance of the site, and document a vision for its conservation, interpretation, and management. The future for Phnom Bakheng is based on the fundamental need to conserve, enhance, and interpret the historic landscape of Yasodharapura evident in the morphological transformation of the cultural landscape of Angkor—in particular the *phnom* and its immediate environs, and its contribution to Angkor's outstanding universal values—while maintaining its authenticity and integrity.

The cultural significance of Phnom Bakheng, as a whole, is provided not only by the survival of the temple complex, but also by the unique integration of its symbolic plan with the natural landscape. It represents a masterpiece of human creative genius for the high quality of its artistic work and the integration of its symbolic form with the natural landscape to create a physical manifestation of a Hindu cosmological template of the perfect universe.

As the most prominent temple-mountain within the context of Angkor, Phnom Bakheng, with its matrix of built features integrated into the landscape is symbolic of Khmer religiosity, and Angkor Park is emblematic of the Cambodian national identity.

If the Khmer lose that connection to their cultural heritage—their past; and if we lose that landscape poetry, then we have all lost a great deal.

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The Phnom Bakheng Workshop on Public Interpretation convened scholars and specialists to gather the most current research on the history, ecology, art and architecture, and use of the site over time. Multidisciplinary presentations and discussions shed further light on the history and scope of the temple-mountain and helped guide the strategy for the public presentation of Phnom Bakheng. The workshop is part of a comprehensive plan for conservation, interpretation, and management of the site.

"The United States is proud to be a partner in the groundbreaking work that the World Monuments Fund is undertaking in cooperation with the APSARA Authority in public interpretation at Phnom Bakheng. For the first time at Angkor Park, a site's significance will be presented in a comprehensive and cohesive manner, creating a more enjoyable and enriching experience for the visitor. This approach can only bolster Angkor's reputation as a site of world cultural renown. In working to preserve—and interpret—Cambodia's past, we are also working to ensure Cambodia's future."

- Ambassador Joseph Mussomeli, U.S. Ambassador to the Kingdom of Cambodia

"Historically, Angkor's temples have been understood for their architectural and monumental features, without sufficient consideration of their natural surroundings or their communities, past and present. The Phnom Bakheng Workshop on Public Interpretation succeeded in convening scholars from different areas of study to reveal the site's socio-cultural significance. Such an inclusive exercise of 'contextualization' is a precedent at Angkor, contributing to the reclamation of ancient Khmer heritage by its conceptors and users, an approach that is central to the mission of the Center for Khmer Studies."

- Philippe Peycam, Director, Center for Khmer Studies

APSARA, Authority for the Protection and Management of Angkor and the Region of Siem Reap, is charged with conserving and improving the value of the archaeological park, the culture, the environment, and the history of the Angkor region as defined on the World Heritage List. The APSARA Authority collaborates directly with international governmental and non-governmental agencies, to coordinate actions undertaken in many domains and to strengthen national technical capacities. It is placed under the supervision of the Presidency of the Council of Ministers and the Ministry of Economy and Finance.

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