THE
ENGINEERING MARVELS
OF

ANGKOR WAT
CAMBODIA

THE ANGKOR TEMPLE COMPLEX CAMBODIA

1. CONQUESTS & EMPIRE
2. MEGALOMANIA & BUILDING
3. DECLINE & FALL
4. DISCOVERY & RESTORATION

THE ANGKOR TEMPLE COMPLEX

1. CONQUESTS & EMPIRE

ANGKOR

THE HEART OF THE KHMER EMPIRE

A BRIEF HISTORY (1)

ANGKOR – A REGION OF CAMBODIA

Seat of the Khmer Empire in Angkorian Period

802 AD - Reign of Jayavarman II

Khmer Hindu Monarch

"God-king of Cambodia"

"Universal Monarch"

629 YEARS

1431 AD - THAIS SACKED THE CAPITAL

A BRIEF HISTORY (2)

802 AD - Jayavarman II

First Capital at Roulos

889 AD – Yasovarman I

New Capital of Yasodharapura

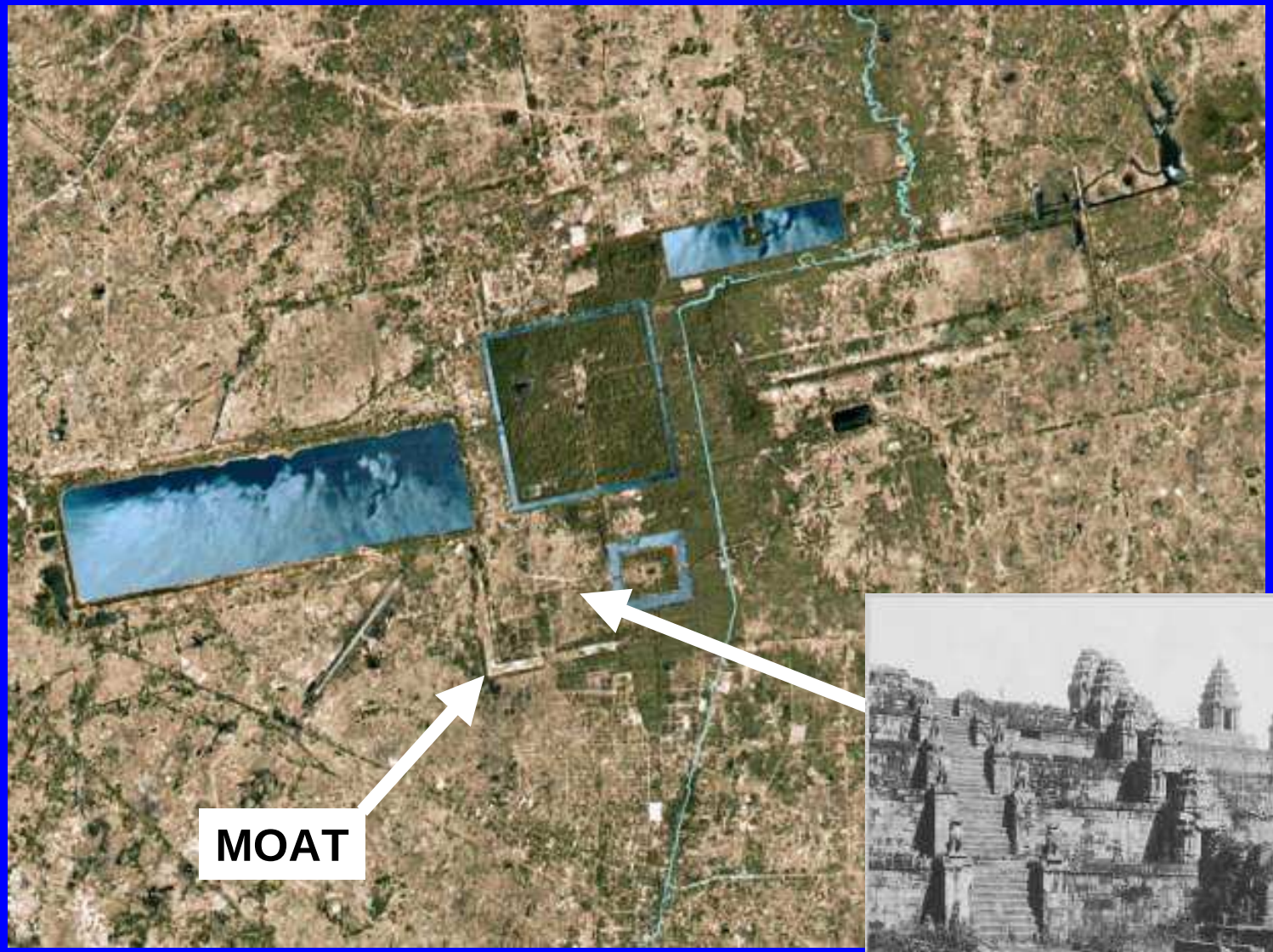
Phnom Bakheng at centre

Early Temple Mountain

Surrounding Moat

PHNOM BAKHENG

A NATURAL TEMPLE MOUNTAIN



PHNOM BAKHENG SITE

THE ANGKOR TEMPLE COMPLEX

2. MEGALOMANIA & BUILDING

Insanity of self-exaltation
Passion for grandiose things

A BRIEF HISTORY (3)

900AD - 1200AD

"A 300 Year Building Frenzy"

Medieval City of Angkor

Area = 2,979 km²

Hong Kong SAR = 1,098 km²

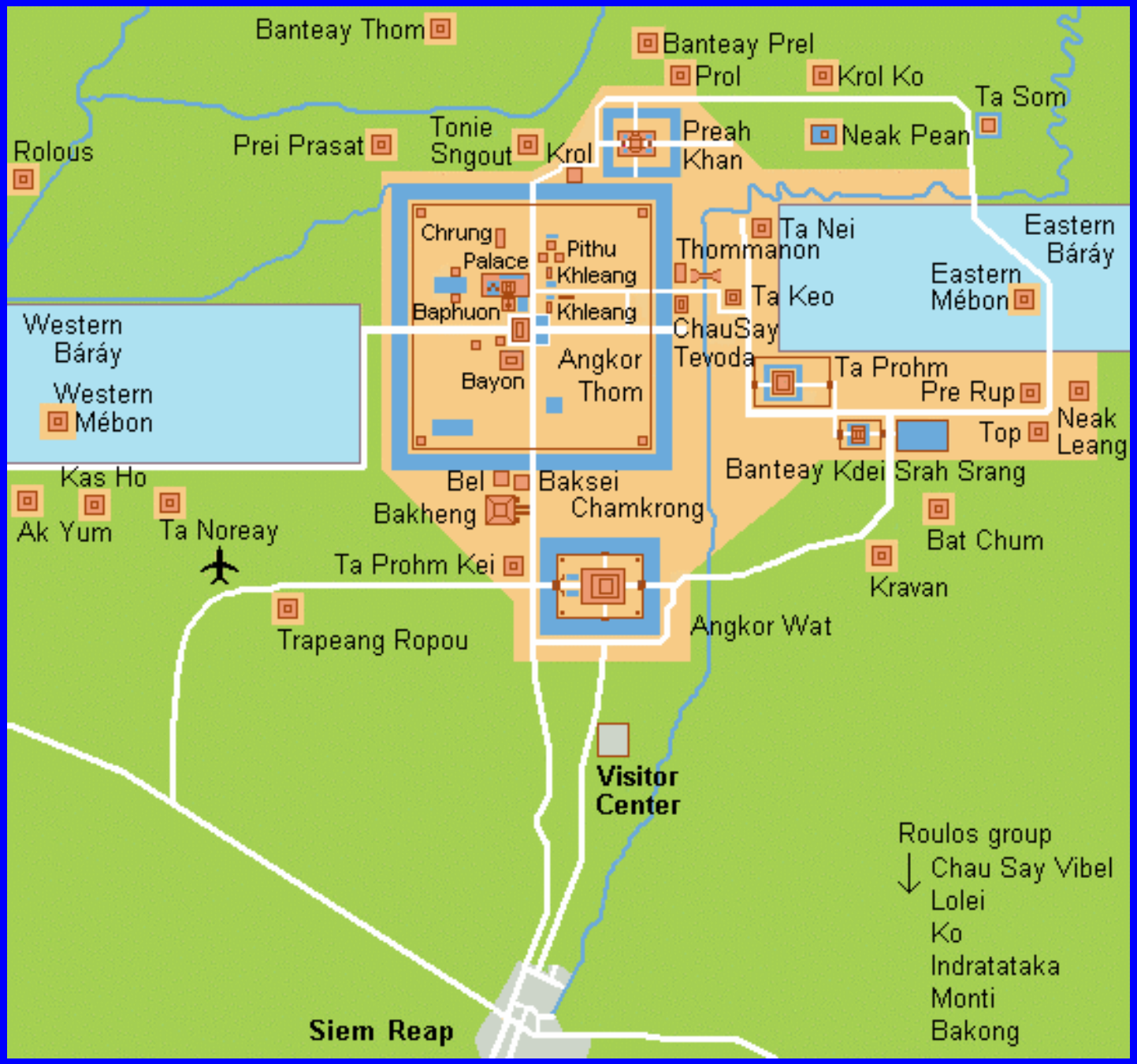
Central Temple Complex (72 Temples)

Area = 104 km²

Hong Kong Island = 80 km²

THE ANGKOR TEMPLE COMPLEX

LAYOUT PLAN



PERSISTENCE OF TEMPLE STYLES

TEMPLE MOUNTAIN STYLE

Early rulers - modelled temples on the sacred Mount Mehru

(mythical mountain in the High Pamirs)

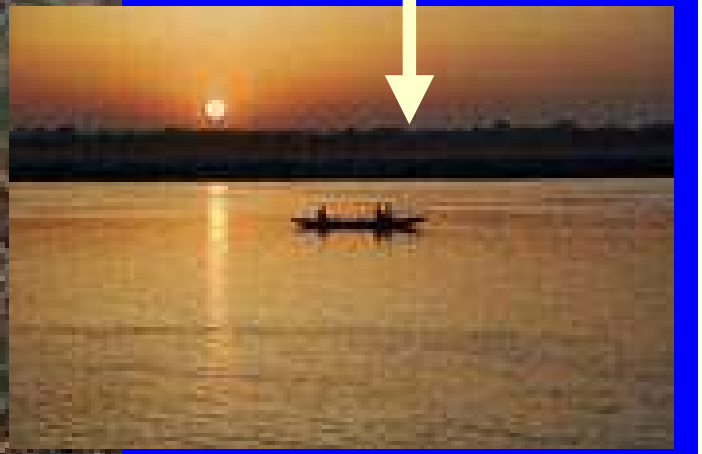
(Sensible if one has a mountain)

Rather than - the more practical sacred Ganges River plains

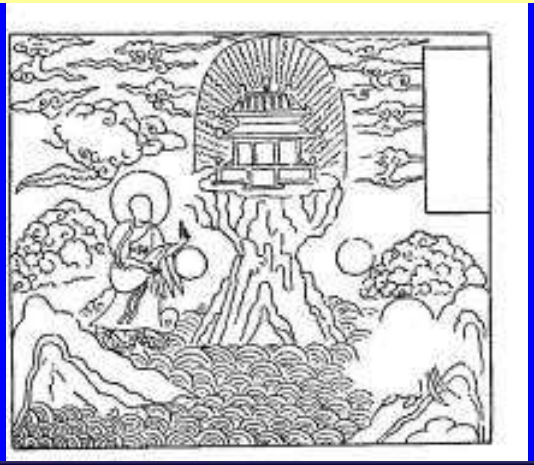
THE SIEM REAP PLAIN

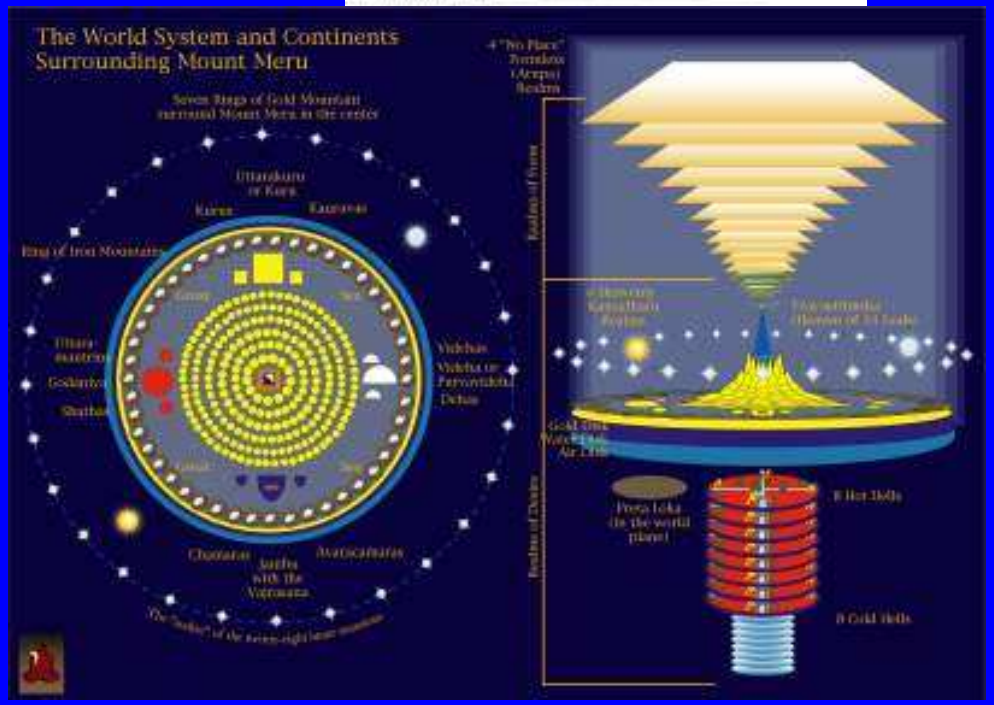
THE SACRED GANGES RIVER

Perfectly Flat Plain



THE MYTHICAL MOUNT MEHRU





THE TEMPLE MOUNTAIN STYLE

Five-peaked Mount Meru

TA KEO (1000AD)

Sandstone Blocks

PRE RUP (961AD)

Laterite Blocks
& Brick Towers

TA KEO TEMPLE MOUNTAIN

SOURCE OF SANDSTONE

KHULEN HILLS – 40 kms to North

TA KEO TEMPLE

EARLY SANDSTONE BUILDING TECHNIQUES

Khmer Woodworking Tradition
Woodbuilding methods used
for stone – tongue & mitre joints

THE
GREAT BARAYS
(WATER RESERVOIRS)

Hariharalaya **(Roulos)**

First Baray (850AD) = 7 Mm^3

Yasodharapura **(Angkor)**

Eastern Baray (900AD) = 50 Mm^3

Western Baray (1050AD) = 80 Mm^3

RICE IRRIGATION - DRINKING WATER - CEREMONIAL SEA

AERIAL PHOTOGRAPH

Western and Eastern Barays

CAPACITY = 50 Mm^3

AREA = 7.1 km x 1.7 km
EMBANKMENTS = 8 Mm^3

THE EASTERN BARAY

THE WESTERN BARAY

The earliest man-made structure visible from space

DATE	RESERVOIRS	CAPACITY m^3
1877	Pok Fu Lam	233,000
1889	Tai Tam Upper	1,490,000
1904	Tai Tam Byewash	80,000
1907	Tai Tam Intermediate	686,000
1910	Kowloon	1,578,000
1917	Tai Tam Tuk	6,047,000
1925	Shek Lei Pui	374,000
1926	Reception	121,000
1931	Aberdeen (2 Res.)	1,259,000
1931	Kowloon Byewash	800,000
1936	Shing Mun (Jubilee)	13,279,000
1957	Tai Lam Chung	20,490,000
1963	Shek Pik	24,461,000
1965	Lower Shing Mun	4,299,000
	TOTAL (15 RES')	75,197,000
	MARINE RESERVOIRS	
1968	Plover Cove	229,729,000
1978	High Island	281,124,000

THE ANGKOR TEMPLE COMPLEX

3. DECLINE & FALL

ANGKORIAN PERIOD

DURATION OF 629 YEARS

802 AD - Reign of Jayavarman II

Khmer Hindu Monarch

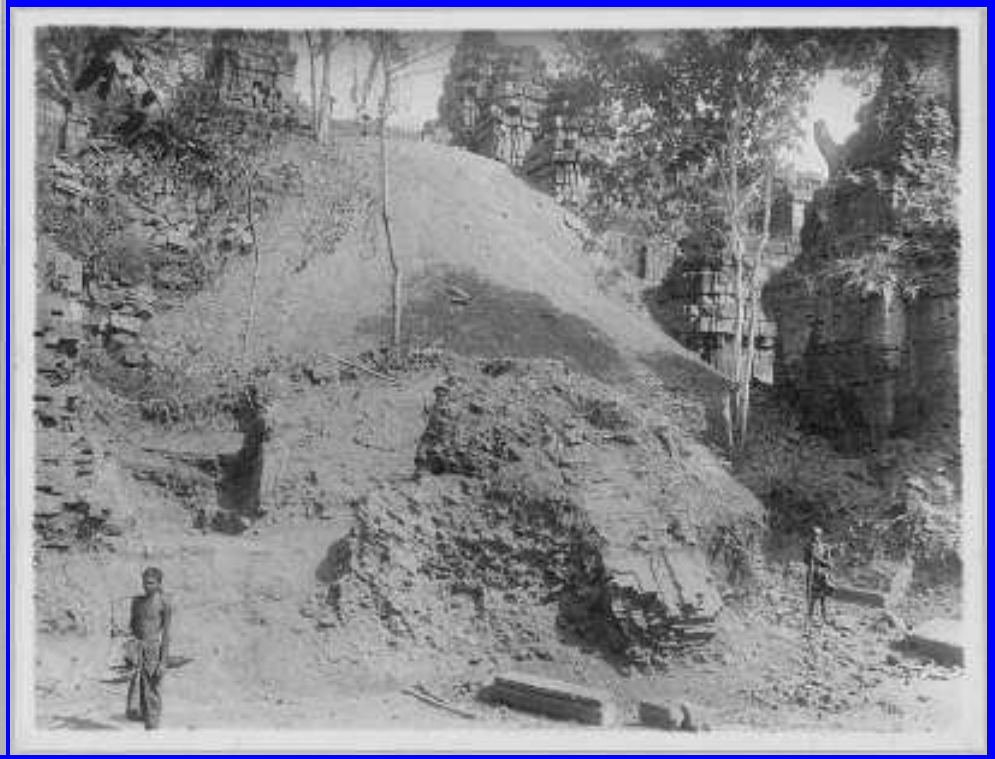
"God-king of Cambodia"

"Universal Monarch"

1431 AD - THAIS SACKED THE CAPITAL

ANGKOR TEMPLE COMPLEX

STRUCTURES OVERWHELMED BY FORESTS

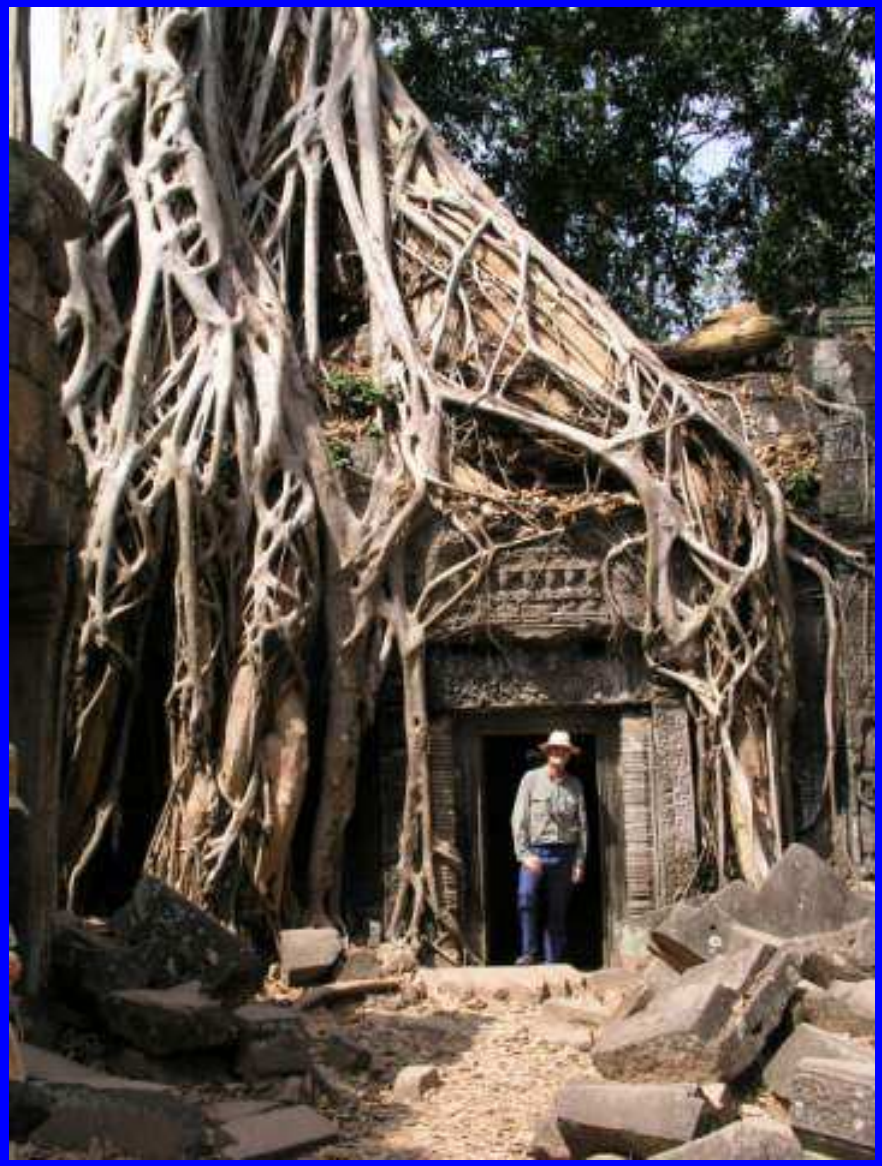


THREATS TO THE MONUMENTS

- TREE AND ROOT GROWTH
- INTENSE RAINFALL
- HUMAN ACTIVITY

TREE & ROOT GROWTH (1)

TREE & ROOT GROWTH (2)



TREE & ROOT GROWTH (3)

INTENSE RAINFALL

INTENSE RUNOFF & SEEPAGE

HUMAN IMPACTS

Squaddies with Guns

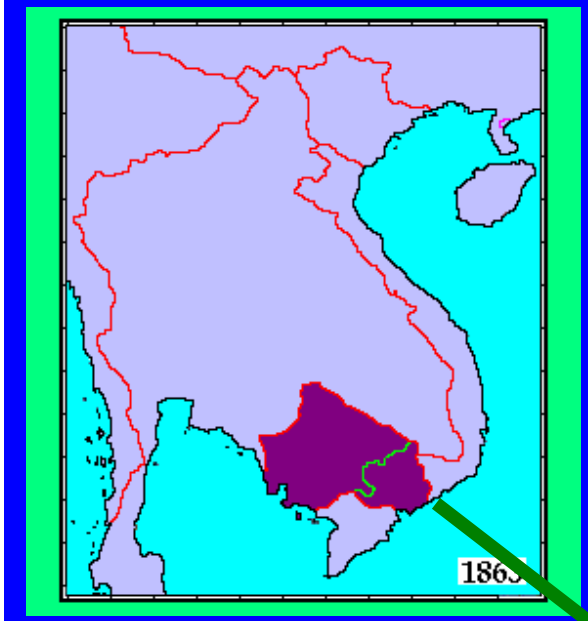
HUMAN IMPACTS

Large Calibre Gunfire

THE ANGKOR TEMPLE COMPLEX

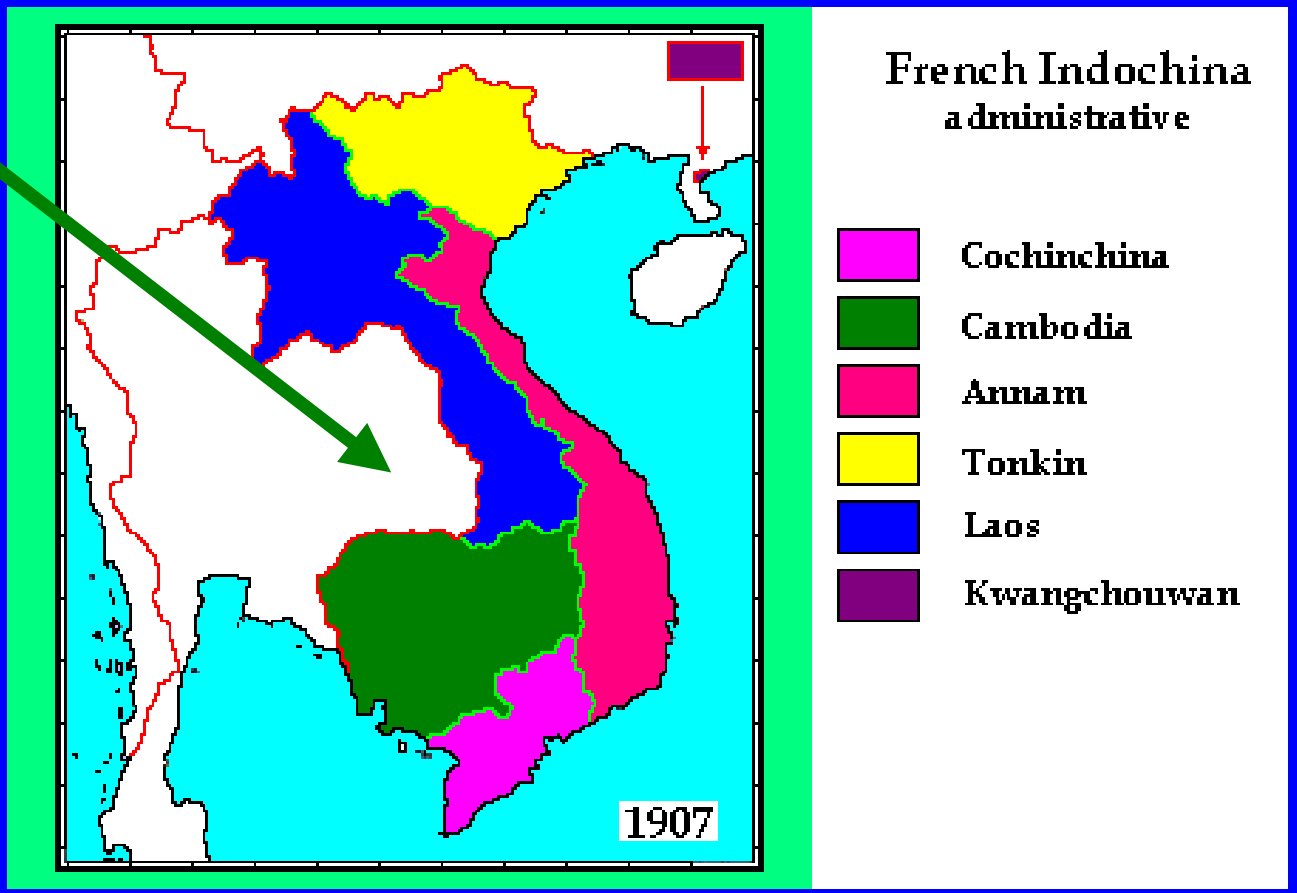
4. DISCOVERY & RESTORATION

FRENCH INDOCHINA



(1863 - 1866)

(1907 - 1918

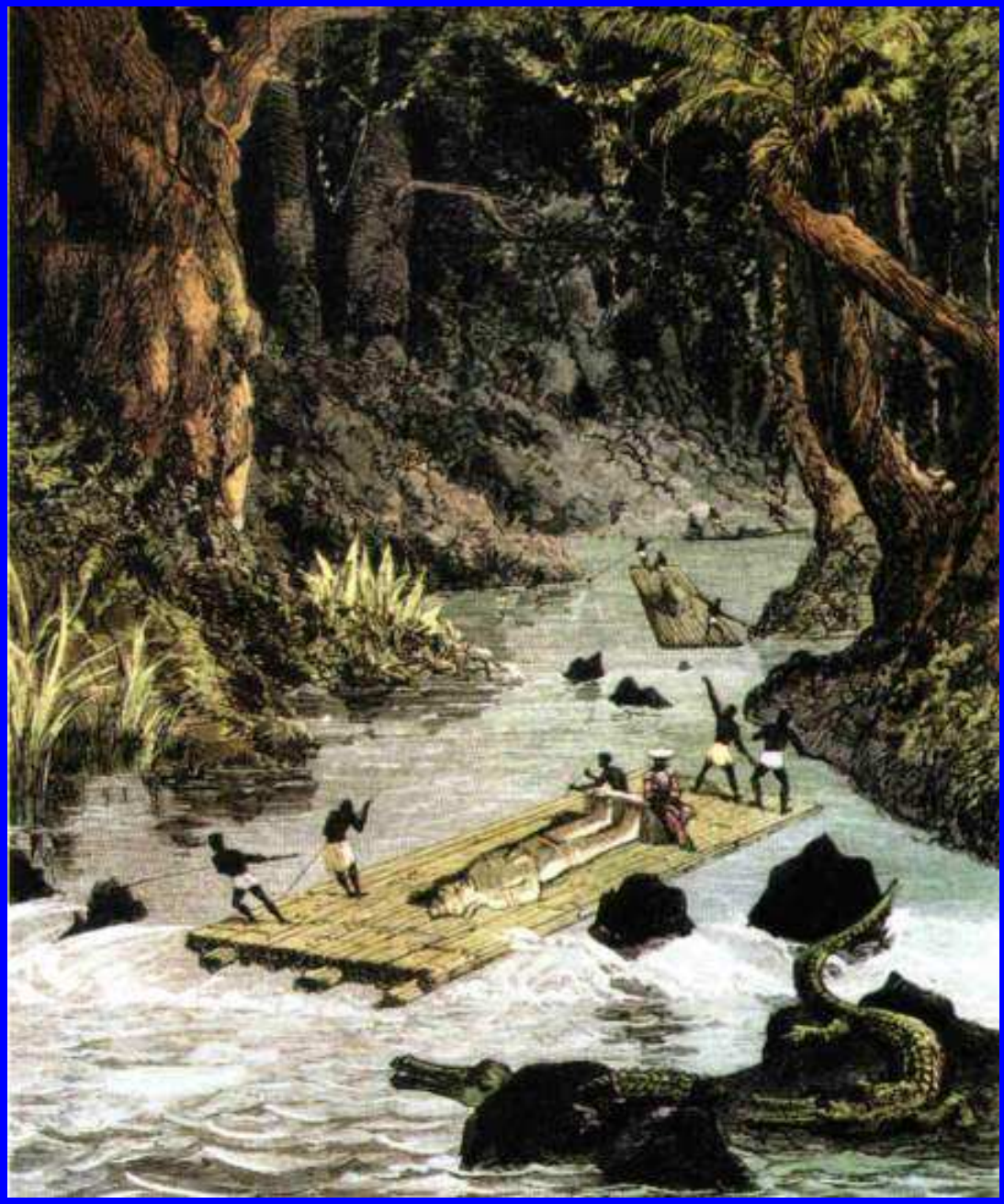


COLONIAL EXPANSION IN 50 YEARS

EARLY FRENCH ARCHAEOLOGICAL CONSERVATION

Removing the statues to France for safe-keeping

Louis Delaporte Expedition 1874



LATER FRENCH ARCHAEOLOGICAL CONSERVATION (1)

VEGETATION CLEARANCE - 1915

LATER FRENCH ARCHAEOLOGICAL CONSERVATION (2)

DISMANTLING

NOTE:
NEAT PILES OF NUMBERED BLOCKS

ULTIMATE FRENCH CONSERVATION METHODOLOGY

1. DRAW PLANS OF STRUCTURE
2. DISMANTLE STRUCTURE
3. NUMBER BLOCKS
4. PILE BLOCKS
5. CATALOGUE LOCATIONS

ULTIMATE FRENCH CONSERVATION

THE COUPE DE GRACE

1. DRAW PLANS OF STRUCTURE
2. DISMANTLE STRUCTURE
3. NUMBER BLOCKS
4. PILE BLOCKS
5. CATALOGUE LOCATIONS
6. LOSE RECORDS IN A WAR

LE MONDE

January 1979

Engineers Wanted

Experienced architectural stonemasons required for puzzling work in Cambodia:

Must be capable of working without:
Qualified Supervision
Instructions
Building Plans

Advice to potential applicants:
Experience of assembling advanced jigsaw puzzles (without the picture) would be a distinct advantage

MODERN APPROACH

RESTORATION

CONSERVATION
&
STABILISATION
IN SITU

Do not rebuild

Leave the blocks in place

Stabilise as necessary

Retain the ancient “feel”

THE END

Thank You