# A BRIEF PRESENTATION OF THE PALEOGEOGRAPHY OF CAMBODIA AT THE HOLOCENE OPTIMUM

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## 1. Introduction

An international program to publish paleogeographic maps of the western Pacific countries at the Holocene Optimum (circa 6,000 years before the present) was carried out by the UNESCO/IOC Working Group on Paleogeographic Mapping. It is in this context that, along with a Cambodian colleague, I have been responsible for compiling a paleogeographic map of Cambodia. Since very little has been published on the paleogeography of Cambodia, this map at the Holocene Optimum may provide some useful infomation to archaeologists working in Southeast Asian countries for understanding the geography at that time.

Most geological and geographical work in Cambodia was first carried out by French geologists and geographers during the French colonial period in Cambodia (e.g. Gubler 1933; Saurin 1935). The work, mainly geological mappings, were then pursued and summarized by Cambodian and Vietnamese in collaboration with French geologists (e.g. Tien ed. 1988, 1991). However, no research on the Holocene paleoenvironments and environmental changes was made at these times, with the exception of a great descriptive study of the Cambodian Quaternary by Carbonnel (1972), due to political unrest during the last quarter century. Recently, environmental changes in the Tonle Sap Lake and the related Mekong River System in Cambodia since the Last Glacial Maximum were described on the basis of analyses of cored sediments from the lake (Mildenhall 1996; Tsukawaki et al. 1997; Tsukawaki 1997, 1998). The paleogeographic map of Cambodia at the Holocene Optimum (circa 6,000 years before the present: Figure 1) is based mainly on a series of studies of cored sediments, while also taking the present geological and topographical features of Cambodia (United States Geological Survey 1971; ESCAP 1993a, 1993b; CCOP 1994; Ministry of Construction of Japan 1998) into consideration.

## 2. Coastal Lines

At present, Cambodia faces the sea, the Gulf of Thailand, only on the southwest. Sea-level fluctuations during the Holocene Epoch are not known in Cambodia, but Carbonnel (1972) correlated the lower marine terraces 1.5 to 2 m and 4 m above present mean sea-level to those of the European Flandrian transgression based on radiocarbon dating results. Since consolidated strata crop out and the alluvial plains

or lowlands are not developed in the southwestern coastal areas (ESCAP 1993a), it is inferred that coastal lines in that area at the Holocene Optimum was more or less like those of the present time. On the other hand, it is known that peat is distributed to a relatively limited extent in the vicinity of the lower reaches of the Mekong and Bassac Rivers in the southeasternmost part of modern Cambodia (General Department of Mineral Resources Cambodia, unpublished data). As this peat, probably formed in the Holocene Epoch, is traceable to Viet Nam along the rivers, there is a high possibility that the lower reaches of the rivers in Cambodia were submerged at the Holocene Optimum and that coastal lines were situated in the southeasternmost part of Cambodia.

### 3. Fluvial and Lacustrine Systems

The Mekong River System and the Tonle Sap Lake (The Grand Lake), the largest lake in Southeast Asia, constitute Cambodia's principal fluvial and lacustrine system. As the lake is connected with the Mekong River by the Tonle Sap River at the present time, the inflow of a great amount of water from the Mekong River through the Tonle Sap River every rainy season causes the lake to expand to more than fivefold its water area. However, sedimentological and micropaleontological analyses and a certain number of AMS radiocarbon datings of cored sediments from the lake (Table 1) have shown that the lake was isolated from the Mekong River before about 5,000 years BP (Tsukawaki 1997, 1998; Tsukawaki et al. 1997). Accordingly, though the actual size (probably much smaller than at present) and shape of the lake at that time are still unknown, it is thought that the lake was situated in the central Tonle Sap Basin isolated from the Mekong River at the Holocene Optimum, and that the lake water flowed out through a river (the Paleo-Bassac River?) to the sea at that time. Further, given the grouping of fluvial terraces along the Mekong River noted by Saurin (1935) and Carbonnel (1972), it is possible that the river level was 5 to 6 m higher than at present.

### 4. Central Alluvial Plain around the Tonle Sap

Subsurface ground structures have been recorded beneath several monuments in the Angkor area situated to the north of the Tonle Sap (Tsukawaki et al. 1995; Tsukawaki and Murakami 1996; Tsukawaki et al. 1998). A number of AMS radiocarbon datings of cored sediments have also demonstrated that the Holocene deposits are very thin, less than one meter thick, if not absent in the area (Tsukawaki et al. 1998) (Table 1).

### 5. Vegetation

Mildenhall (1996 ms) reported that the pollen and spore assemblages from two horizons (*circa* 6,500 and 5,500 years before the present) of the cored sediments from the central part of the Tonle Sap resemble those of the flora around the lake at present, though a small number of mangrove pollens were recognized from the lower horizon. It is therefore thought that vegetation in Cambodia at the Holocene Optimum was almost the same as at present. There is a possibility that mangrove habitats were distributed

in the lowest reach of the river which connected the lake with the sea at that time.

## 6. Human Activities

Vu (1994) briefly summarized prehistoric archaeological studies in Cambodia carried out mainly by French and Japanese archaeologists. The period around the Holocene Optimum is correlated with the early Neolithic Age of archaeological time units in Cambodia. A limited number of archaeological sites at that age are known in the northwestern, central and southwestern coastal regions of Cambodia; a number of radiocarbon ages were reported at some of these (Table 1).

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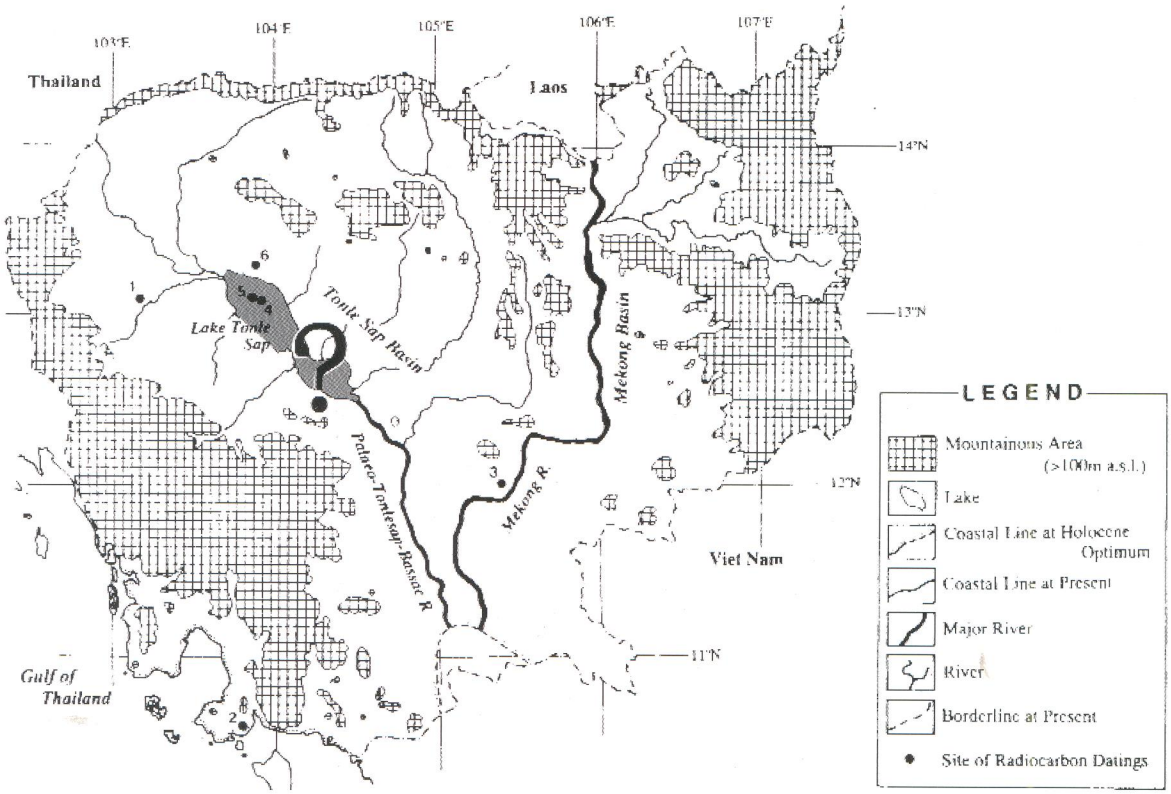


*Figure 1. Paleogeographic map of Cambodia at 6,000 years before the present.*

*Radiocarbon Datings in Cambodia*

| Idx. No. | Original Code | Lab No. | Area | Site | Latitude (N) | Longitude (E) | Height or Depth (cm) | Material | 14C Age (y.BP) | Reference | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Archaeological Sites** | | | | | | | | | | | |
| 1 | ? | ? | Battambang | Loang Spean Site | ? | ? | ? | charcoal? | 8750 +/- 90 | Mourer and Mourer, 1968? | in Vu, 1994 |
| 2 | ? | ? | Kampot | Kbal Romeas Site | ? | ? | ? | shell | 5370 +/- 40 | Carbonnel, 1966? | in Vu, 1994 |
| 3 | ? | ? | Kompong Cham | Mimot, Chup Thmas Pick | ? | ? | ? | charcoal | 2130 +/- 100 | Groslier, 1962? | in Vu, 1994 |
| 3 | ? | ? | Kompong Cham | Mimot, Chamess Andong | ? | ? | ? | charcoal? | 1150 +/- 100 | Groslier, 1962? | in Vu, 1994 |
| **Cored Sediments from Lake Tonle Sap** | | | | | | | | | | | |
| 4 | TS96-1 | NZA-6493 | Lake Tonle Sap | N of the lake | 13 07 36 | 103 53 58 | 42 - 48 | bulk sediments | 5081 +/- 86 | Mildenhall, 1996 (MS) | in Tsukawaki, 1997 |
| 4 | TS96-1 | NZA-6494 | Lake Tonle Sap | N of the lake | 13 07 36 | 103 53 58 | 106 - 110 | bulk sediments | 6233 +/- 84 | Mildenhall, 1996 (MS) | in Tsukawaki, 1997 |
| 4 | TS96-1 | NZA-6530 | Lake Tonle Sap | N of the lake | 13 07 36 | 103 53 58 | 110 - 116 | bulk sediments | 6505 +/- 88 | Mildenhall, 1996 (MS) | in Tsukawaki, 1997 |
| 5 | TS96-2 | NUTA-4985 | Lake Tonle Sap | N of the lake | 13 07 55 | 103 51 20 | 20 | Corbicula sp. | 630 +/- 100 | Tsukawaki et al., 1997 | |
| 5 | TS96-2 | NUTA-5137 | Lake Tonle Sap | N of the lake | 13 07 55 | 103 51 20 | 45 - 53 | bulk sediments | 5620 +/- 120 | Tsukawaki et al., 1997 | |
| 5 | TS96-2 | NUTA-4984 | Lake Tonle Sap | N of the lake | 13 07 55 | 103 51 20 | 103 - 108 | bulk sediments | 6070 +/- 90 | Tsukawaki et al., 1997 | |
| **Alluvial Plain (Tonle Sap Basin)** | | | | | | | | | | | |
| 6 | EB-N' 260-280 | NUTA-5477 | Siem Reap (Angkor) | East Baray | 13 27 07 | 103 55 07 | 260 - 280 | bulk sediments | 11,000 +/- 200 | Tsukawaki et al., 1998 | |
| 6 | EB-N' 260-280 | NUTA-5505 | Siem Reap (Angkor) | East Baray | 13 27 07 | 103 55 07 | 260 - 280 | bulk sediments | 10,980 +/- 120 | Tsukawaki et al., 1998 | |
| 6 | EB-S 160-180 | NUTA-5808 | Siem Reap (Angkor) | East Baray | 13 26 25 | 105 55 29 | 160 - 180 | bulk sediments | 2540 +/- 110 | Tsukawaki et al., 1998 | |

*Table 1: Selected radiocarbon datings in Cambodia around the Holocene Optimum (circa 6,000 years before the present).*

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