

Topographical Analysis of the Southern Basin of the Central Plain, Thailand

by

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The Central plain, which develops along the middle and lower reaches of the Chao Phraya, is a strip of land 500 km long, north to south, and 100 km wide. It is topographically divided into three parts; the Northern basin, the Nakhon Sawan area, and the Southern basin.²⁾ The Northern basin coincides with the drainage basin of the three big tributaries into the Chao Phraya; the Ping, the Yom and the Nan, and has an elevation ranging approximately from 25 to 100 m. In the Nakhon Sawan area three big tributaries join together to form the trunk river of the Chao Phraya, which passes through a narrow valley to the point where the first distributary splits this trunk river. The Southern basin is occasionally called the deltaic plain and is characterized by flat low lying land less than 15 m above sea level and well developed distributaries of the Chao Phraya, such as the Suphan Buri and the Noi. In this paper topographic characteristics and the geohistory of the Southern basin are discussed.

I Topographic characteristics

I-1 TOPOGRAPHIC UNITS APPEAR ON A CONTOUR MAP

Fig. 1 is a contour map of the Southern basin prepared by this writer based on the existing topographical map of 1:50,000³⁾. Two facts are very sharply demonstrated by this figure and Fig. 2, which is produced from Fig. 1, with stress on the 5 m contour line. First, the Southern basin can be divided into two parts with a border line at approximately 14°30' N latitude. The northern and the southern halves are respectively termed "the Singburi plain" and "the Bangkok low land", taking the name of a representative city situated in each half. Second, a valley-like depression cuts the Singburi plain diagonally from NW to SE. In this paper this valley-like depression is termed "the Ban Phraek trough".

The following is a brief sketch of the three topographic units.

Singburi plain

Ground height ranges from 5 to 15 m with a mean slope of approximately 10 m/100 km. The prime configuration of this plain is presumed to have been formed during the late Pleistocene as a terrace. This frame work was then modified by younger

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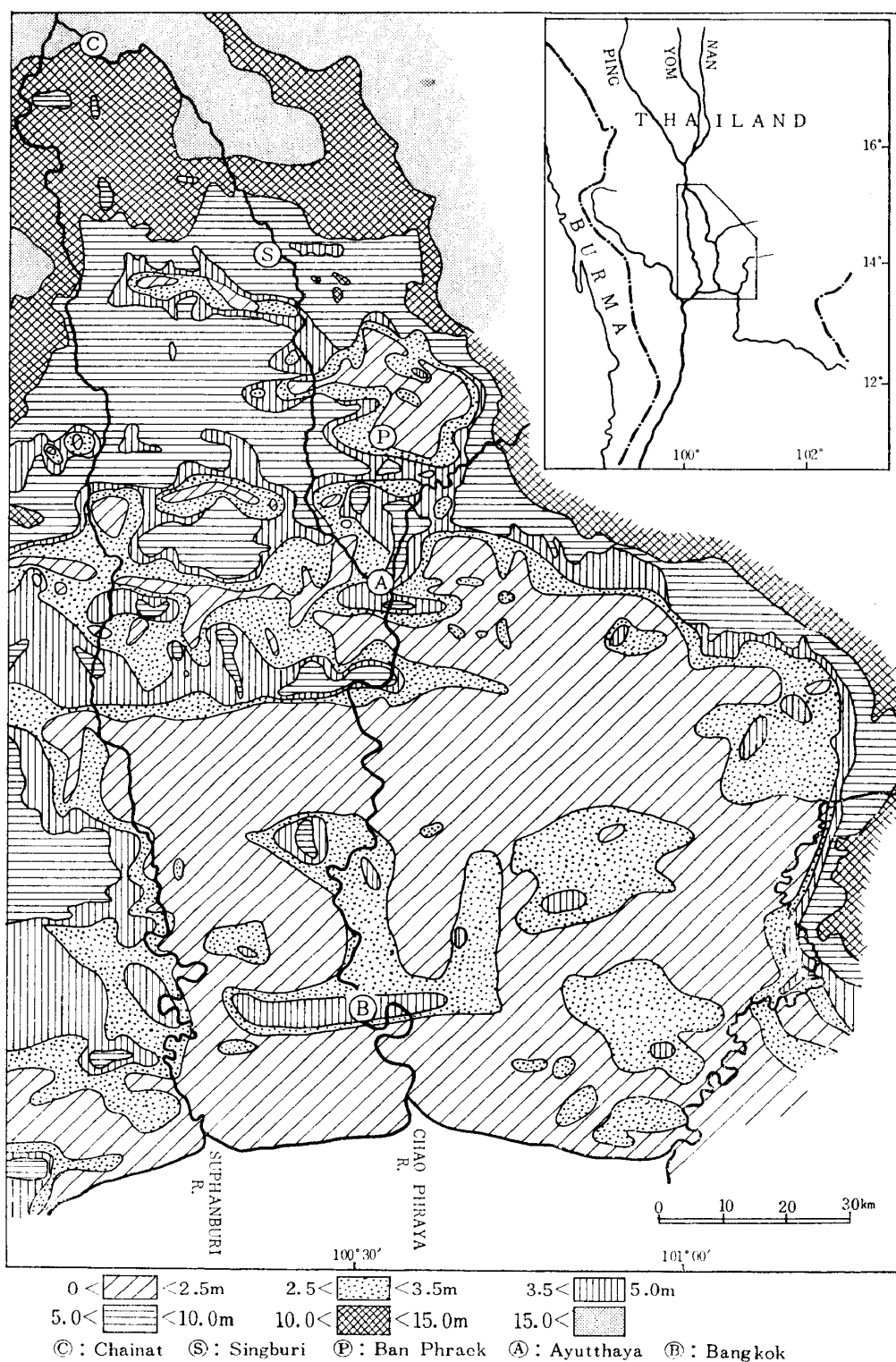


Fig. 1 Contour map of the Southern basin of the Central plain

deposits of recent natural levees. Natural levees are well developed along the big river courses, forming a higher zone with depressional stretches of back swamp behind it. Thus the existing topography is highly oriented north and south, as shown in profile

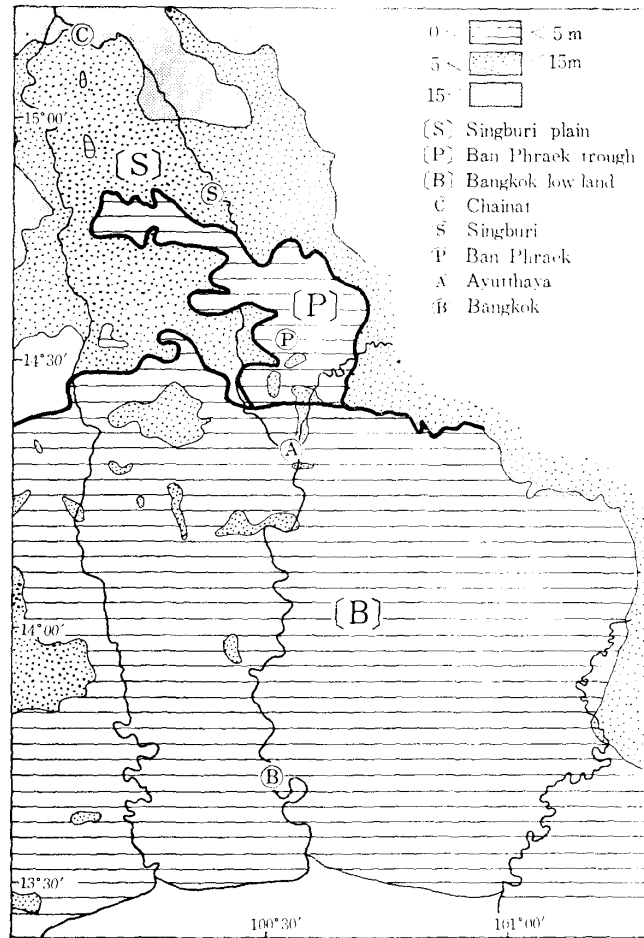


Fig. 2 Map showing the Singburi plain, the Ban Phraek trough and the Bangkok low land

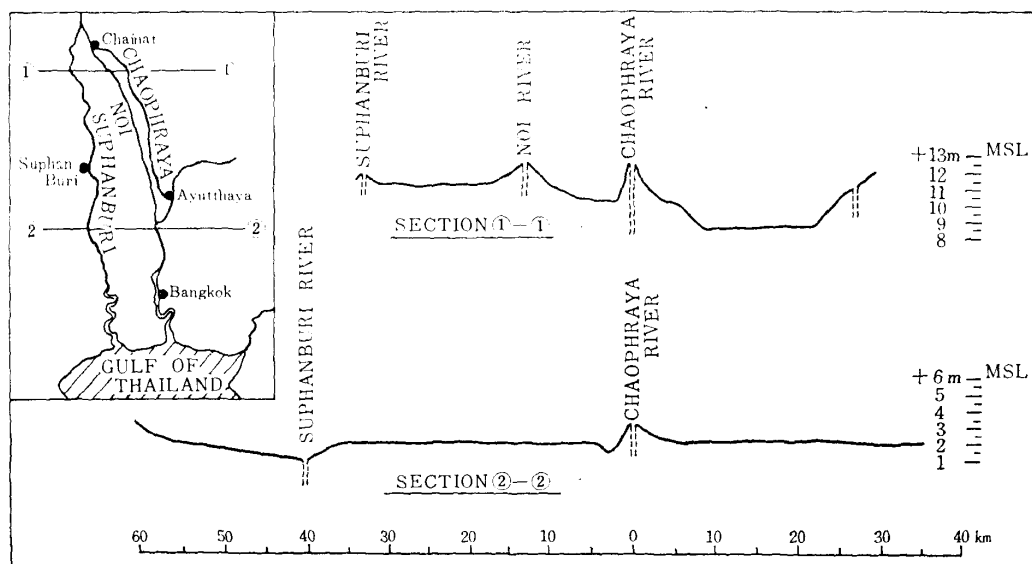


Fig. 3 Two representative E-W cross-sections in the Central plain (from Water Resources Series No. 25, U.N.⁴⁾)

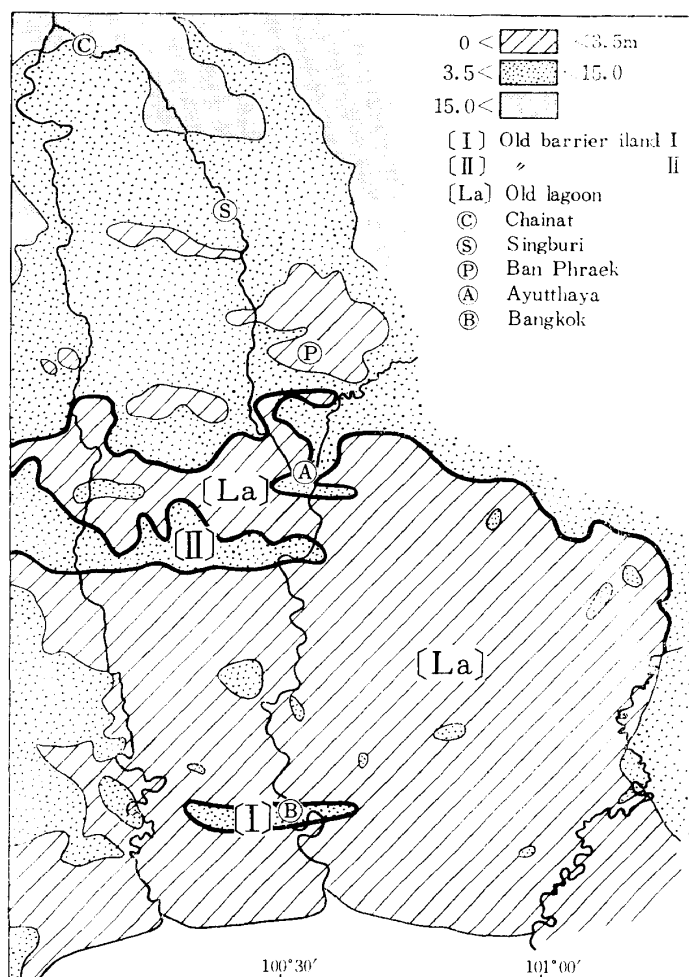


Fig. 4 Map showing a web of the Old barrier islands and Old lagoons

No. 1 in Fig. 3. Scenically, the levee area is characterized by garden trees, whereas slightly undulating paddy field with few standing trees and termite mounds are most commonly observed in the Singburi plain proper behind the levees.

Bangkok low land

Ground height averages 2 m with some exceptionally elevated areas more than 5 m. The mean slope is less than 4 m/100 km. No standing trees are seen except for small bamboo clumps along canals and palmyra palms on swells (old barrier islands). The N-S trend, developed in the Singburi plain, vanishes and a web of old barrier island-like swells and lagoon-like swales appear, with an E-W direction, as shown in Fig. 4.

The most beautiful barrier island-like swell which is termed "Old barrier island II" (see Fig. 4) extends about 60 km in an E-W direction with a breadth of approximately 10 km. This swell has an asymmetric shape with an irregular northern backshore and a smooth, almost straight southern foreshore. This characteristic shape reminds the writer of a classic barrier island. A similar type of elevated area, though of smaller dimension, is recognized at the position named "Old barrier island I". The higher part, on which the city of Ayutthaya is located, seems to comprise another old barrier island.

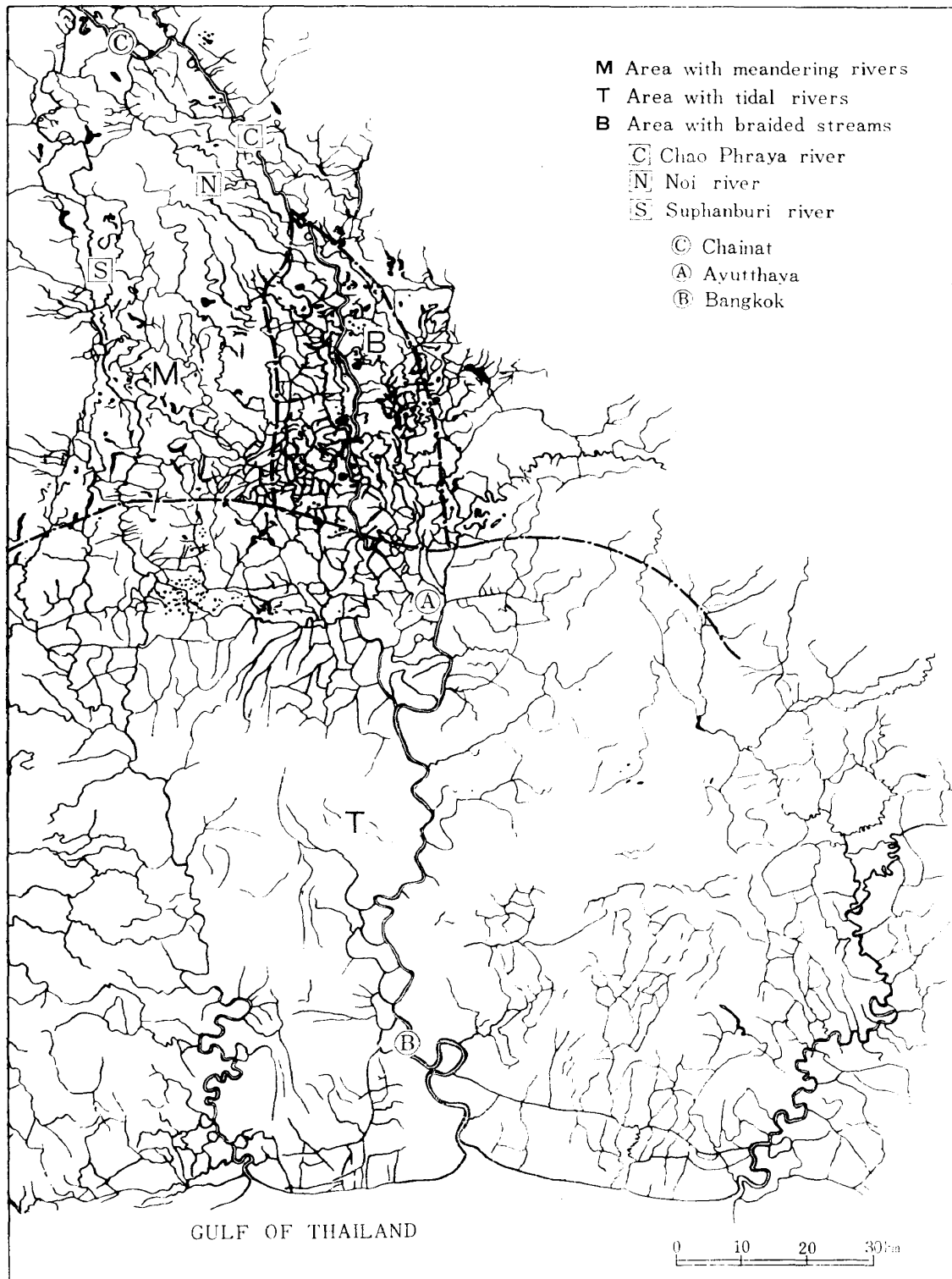


Fig. 5 Potamologic map of the Southern basin of the Central plain

These old barrier islands have 2 to 3 m higher elevations than the surrounding low-lying old lagoonal areas; the maximum for barrier island I being about 5 m.

Ban Phraek trough

The valley-like depression shown in Fig. 2 has its head at the east bank of the Suphan

Buri, crosses the Chao Phraya and goes down to Ayutthaya. This course doesn't coincide with any existing big river channels. The floor of the Ban Phraek valley lies 2 to 5 m lower than the average ground surface of the Singburi plain. The surface is flat to slightly undulating, and standing trees and termite mounds are so scarce that its scenic features resemble those of the Bangkok low land.

I-2 POTAMOLOGIC UNITS APPEAR ON A WATER SYSTEM MAP

Fig. 5 is a map illustrating the water system of the Southern basin which was prepared by the writer based on the topographical map of 1:50,000³⁾. This map shows three potamological units; "Area with meandering rivers", "Area with tidal rivers" and "Area with braided streams". The following are the brief descriptions of these units.

Area with meandering rivers

The Suphan Buri and the upper reach of the Noi, which are thought to be abandoned river channels of the Chao Phraya, pass through this area. These have rather too well developed natural levees for the breadth of their present channels, as shown in profile No. 1 in Fig. 3. Meanders and ox-bow lakes are commonly observed. The river density is medium. The extent of this area nearly coincides with the Singburi plain, which appears on the contour map.

Area with tidal rivers

This area corresponds to the Bangkok low land. River channels in this area seem to be more stable than those in the area with meandering rivers, lacking abandoned river courses and ox-bow lakes. Owing to low elevation and very slight gradient, its rivers show characteristics of a tidal river with large curvature of meander. River density is low.

Area with braided streams

This area shows a fan-shape with the city of Singburi at its apex. The Chao Phraya and the lower half of the Noi bisect this area with numerous small and shallow distributaries, demonstrating a braided stream pattern. Because of ubiquitous branching, the trunk channels of the two rivers seem to have reduced dimensions.

II Geohistorical analysis of topographic and potamologic units

The origin of the development of the three topographic units: the Singburi plain, the Bangkok plain and the Ban Phraek trough, and the development of the potamologic area, the Area with braided streams, may be assessed as follows.

II-1 DEVELOPMENT OF THE SINGBURI PLAIN

The N-S trend (observed in Fig. 3) is a superficial phenomenon provided by the loamy natural levee deposits of recent age. The framework of the Singburi plain itself has a non-oriented flat depositional surface, whose near-surface layer is clayey. This suggests that the main body of the Singburi plain was formed under an open stretch of water, most probably under the old Gulf of Thailand.

Sediments comprising the Singburi plain proper, or the clayey strata beneath the levee deposits, have apparently undergone a greater degree of weathering than those forming the Bangkok low land. This may be taken as proof that the former is older than the latter, consequently having a more strongly weathered feature.

The bulk of the Singburi plain is thus, assumed to have been formed under a probable, sea-facing environment during a high sea level stage prior to the stage in which the Bangkok low land was formed.

II-2 TRENCHING THE SINGBURI PLAIN

After the high sea level stage which formed the Singburi plain, there came a low level stage, which brought about a trenching of the Singburi plain. The origin of the Ban Phraek trough (shown in Fig. 2) may be explained as the engraving of the Singburi plain induced by this lowering of sea level.

The eastward shift of the main course in the Southern basin, from the Suphan Buri to the Chao Phraya, is presumed to have already started at this stage. The fact that the Ban Phraek trough has a locus of a NW-SE trend, which starts on the bank of the Suphan Buri, passes the Chao Phraya and reaches the Bangkok low land, seems to support this assumption.

The lower reach of the trough is overlapped by clay of the Bangkok low land. This implies that the trench is older than the Bangkok low land. The most probable assumption is that the formation of the Ban Phraek trough was simultaneous with the low sea level substage of the last glaciation.

II-3 DEVELOPMENT OF THE BRAIDED STREAMS

The area with braided streams is almost entirely confined within the Noi and the Chao Phraya drainages, and the braided pattern itself is well preserved. This indicates that the braided streams are very young. From topographical analysis, this writer concludes that the streams are even younger than the Ban Phraek trough.

The area has approximately the same elevation as the adjoining Singburi plain in the north, but its height decreases toward the south until it submerges beneath the flat clayey surface of the Bangkok low land. Apparently this area was formed before the Bangkok low land.

A similar type of braided stream system is reported in the lower Mississippi valley which is determined to be early recent in age. By typological analogy, the writer assumes that the age of the braided streams in the Southern basin is of the rising sea level substage in the Holocene Era.

II-4 LAST INVASION OF THE SEA

The bulk of the deposits in the old lagoon area of the Bangkok low land is composed of brackish clays, whereas those of the old barrier islands are made up of alternate layers of sand, silt and clay. In both areas, needle shaped gypsum crystals are most commonly evolved just below the surface, and brackish faunal remains such as shells and

crabs are occasionally intercalated in the sandy and/or silty layers. These facts, together with the characteristic topographical arrangement of the old barrier islands and lagoons, signify that the Bangkok low land was formed under littoral environment. Topographical analysis shows that during this period the Gulf of Thailand had its shore line more than 100 km inland and that the sea level was several meters higher than at present.

Drilling data reveal that brackish clay is 14 m thick in Bangkok. It is very loose, with almost no bearing capacity and shows no signs of weathering.¹⁾ These data seem sufficient to determine that the clay is very young, and that the Bangkok low land has been developing during the last stage of the Holocene, including the post-glacial high standing sea level substage.

The geomorphology of the Southern basin is summarized as follows;

Unit	Environment	Stage
Bangkok low land	Latest sea invasion	Recent high standing sea level sub-stage
Braided stream area	Filling of trough	Rising sea level sub-stage
Ban Phraek trough	Trenching the Singburi plain	Low sea level sub-stage
Singburi plain	Penultimate sea invasion	Pleistocene high standing sea level stage

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