

CHAPTER 44

STUDIES ON THE SHORE PROCESS AND WAVE FEATURES OF THE WESTERN COAST OF TAIWAN

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SYNOPSIS

The western coast of Taiwan has been accumulated to vast area of tidal flats by the sediment transported from numerous torrential streams. According to the aerial photographs, 53,800 hectares of tidal land are worth being reclaimed. However, this coast suffers from waves generated by winter monsoons as well as waves and swells caused by typhoons in the summer. Studies on the historical processes and future development of the shoreline are of great significance.

The ancient topographical data in An-Ping and Tseng-Pa areas as well as recent coastal line variations of Tseng-Pa and Yulin are reported in this paper, also the general features of waves along this coast are described. The future of the coast is predicted as a conclusion.

HISTORICAL DATA ON COASTAL CHANGE

Taiwan is the eastern province of the Republic of China that is surrounded by the sea (Fig 1) and has a total coastline of 1,566 kilometers. The type of the west coast is one of deposition, and there is a large area of tidal flats formed before long ago. At the present there are 53,800 hectares tidal land to be developed.

According to historical data and results analyzed, this coast extended offshore since 1624 until 1961 as shown in Fig 2 and Table 1. Here An-Ping coast means the coast area nearby the city An-Ping, and Tseng-Pa coast means the coast area between rivers Tseng-wen and Pa-Chang.

WAVE CHARACTERISTICS ON THE COAST

From September to March of last year, anticyclones of large intensity (some 1040 millibars) occur continuously in the vicinity of Bering Lake and move due southeast. Finally, they weaken and vanish in the Pacific Ocean.

While the anticyclone is moving, wind from NE or NNE direction blows over the East China Sea and Taiwan Strait with velocities of 10-20 m/sec. Due to the long duration of the wind, relatively large waves are generated. According to measured data in the middle and south section of the coast, waves 2-3 meters high and 6-8 seconds in period exist on this coast most of the winter. The steepness of these waves are large and the bed materials of the coast are as fine as 0.2 mm. Apparently the sand of the coast is eroded by the waves and is moved in a southerly direction.

In the summer months, winds from SW-S blow in the afternoon and the velocity rarely exceeds 10 m/sec. Waves generated by such wind are small, however, during these months typhoons frequently occur and cause considerable damage. The waves caused by typhoons sometimes are 7 meters in height and 12 seconds in period. These waves and swells also cause shoreline changes on the coast. The coast is severely eroded and the sand drift moves offshore. The coast does recover the sand when the winter monsoons begin.

RECENT SHORELINE PROCESSES OF TSENG-PA AND YULIN

There are a series of offshore dunes along the Tainan coast. After the Tseng-Wen polder was reclaimed, most of the dunes became more stable than before. Only near the inlets between the dunes were changed seriously during the winter monsoons, thereby causing damage to the north dike of the polder Tseng-Wen. Sometimes, owing to the fluctuation of climate and sea level during typhoons, the dunes are broken and new inlets are formed. The tendency of shoreline processes in this area is one of erosion (Fig. 3).

By means of hydrographic surveys and aerial photographs, we also provided valuable evidence of coastal and offshore changes in the Yulin area (Fig. 4). Profiles in this area are shown in Fig. 5. The shoreline process in this area is one of erosion.

CONCLUSIONS

- 1 The western coast of Taiwan was the result of deposition by north to south drift during ancient times. The sources of supply of sand drift was from high mountains and torrential streams.
- 2 According to the wave characteristics and bed material, this coast now suffers by erosion.
- 3 In ancient times the sand supply exceeded that which was eroded. The rivers have been regulated since the beginning of this century and also soil conservation works have been constructed. Thus the coast has begun to erode because of the sand supply which has been considerably decreased.

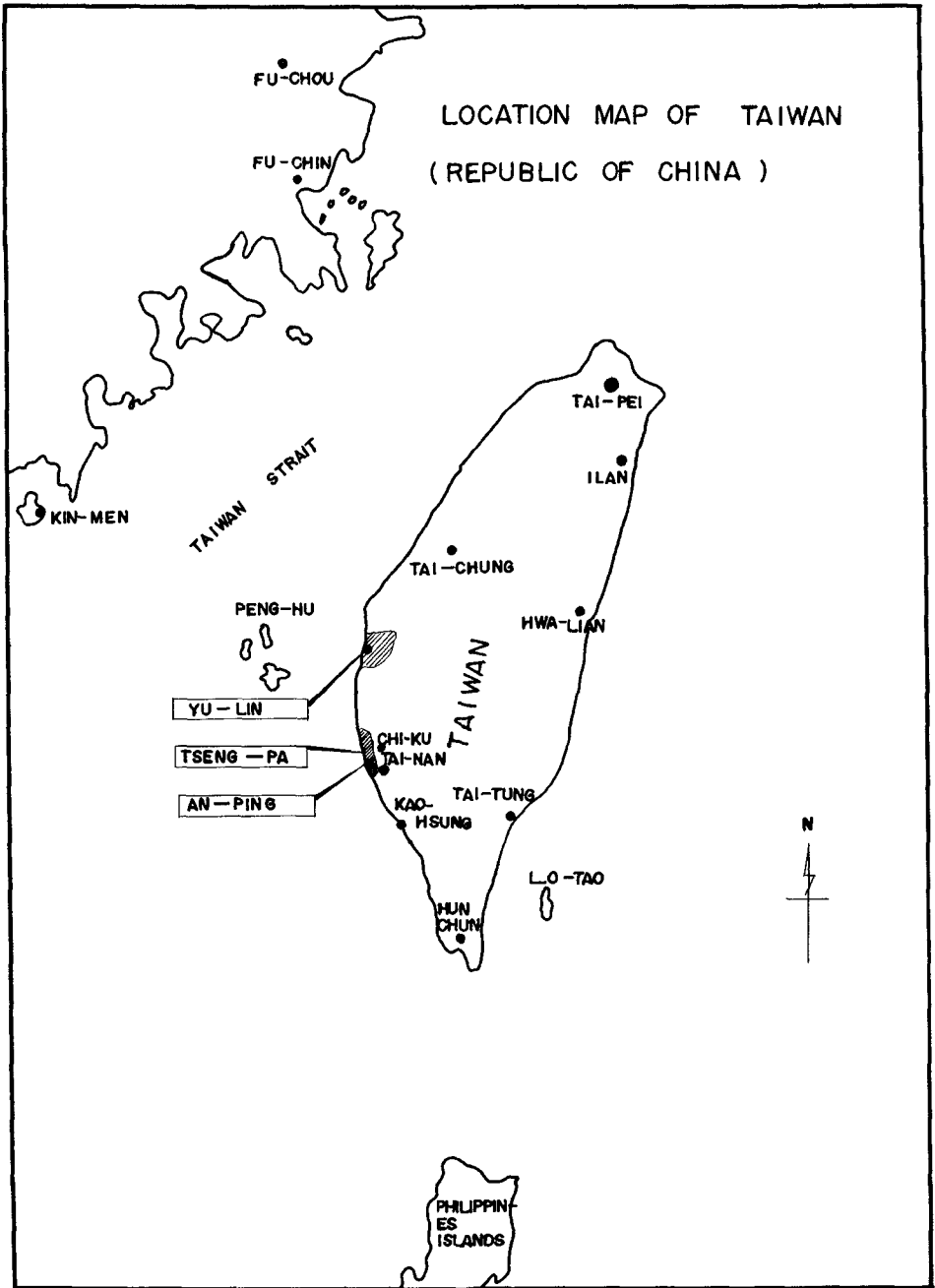
- 4 Although the erosion is not serious today, methods of shore protection must be undertaken. The reclamation of tidal land is of great significance from the economical point of view.
- 5 The shore process of this coast is very complicated and interesting, and detailed studies should be conducted.

SHORELINE PROCESSES OF AN-PING COAST

TABLE 1

THE PERIOD OF COASTAL ACCRETION	PERIOD	THE MAIN FORMATION AND TYPES OF THE COAST	THE UTILIZATION OF COAST AND TIDAL LAND	DATA RESOURCES	
ANCIENT (TAI-KIANG) PERIOD		CRUSTAL MOVEMENT UPLIFTING MOTION GEOLOGICAL CONDITION SANDY COAST FORMATION DEPOSIT ALLUVIUM TYPE BAY SURROUNDED BY OFFSHORE BARS ACCRETION RATE 33.4 M/YEAR UPLIFTING MOTION IN CRUSTAL MOVEMENT		TAIWAN HISTORY	
	FIRST STAGE	FROM 1624 TO 1662 (38) YEAR	MANY OFFSHORE BARS FORMED NATURAL HARBOUR BAY AGE IN EARLY YOUNG STAGE	VESSELS ANCHORAGED IN THE BAY A SMALL AMOUNT OF SALT PANS WAS RECLAIMED	TAIWAN HSIN HISTORY
	MIDDLE STAGE	FROM 1662 TO 1722 (60 YEARS)	SEDIMENTATION IN THE BAY BARS INCREASED AGE IN EARLY YOUNG STAGE	DITTO	TAIWAN HSIN HISTORY
	LAST STAGE	FROM 1722 TO 1822 (100 YEARS)	OFFSHORE BARS ENLARGED AND CONNECTED WITH LAND FORMED LAGOONS THE FORM OF BAY VANISHED AGE IN YOUNG STAGE	SALT PANS INCREASED AND RECLAIMED FISH PONDS	KAHSIUNG HARBOUR HISTORY
RECENT COASTAL PERIOD	FROM 1822 TO 1894 (72 YEARS)	CRUSTAL MOVEMENT UPLIFTING MOTION GEOLOGICAL CONDITION SANDY COAST FORMATION DEPOSIT ALLUVIUM TYPE LAGOONS SILTED UP LAND OFFSHORE BARS BECAME NEW COAST, PRODUCED NEW RIVERS AND NEW OFFSHORE BARS FORMED AGE IN YOUNG STAGE ACCRETION RATE 27.9 M/YEAR	VESSELS ANCHORAGED IN THE BAY SALT PANS AND FISH PONDS INCREASED AND ALSO SETTLERS INCREASED	KAHSIUNG HARBOUR HISTORY	
NOWADAYS PERIOD (EARLY STAGE)	FROM 1894 TO 1945 (51 YEARS)	1 AN-PING COAST BECAME STABLE LAND 2 TSENG-PA COAST (OLD SHAW-LOONG COAST) NEW OFF-SHORE BARS AND LAGOON FORMED AGAIN AGE IN YOUNG STAGE OTHER ITEMS SAME AS BEFORE	MODERN HARBOUR WAS CONSTRUCTED MUCH MORE SALT PANS AND FISH PONDS WERE RECLAIMED	HISTORY OF TAIWAN ECONOMICS AND OLD MAPS	
NOWADAYS PERIOD (NEW STAGE)	FROM 1945 TO (21 YEARS)	TYPE 1 AN-PING COAST ALREADY FIXED OFFSHORE BAR AND TIDAL LAND NO LONGER EXISTING AGE IN MATURE STAGE 2 TSENG-PA COAST - OFFSHORE BARS CONTINUOUSLY ACCRETED AND LAGOON WAS FORMED	TIDAL LAND WAS DEVELOPED WITH MODERN TECHNICS	HISTORY OF TAIWAN ECONOMICS AND OLD MAPS	
TOTAL	342 YEARS	ACCRETION RATE LAN-PING 28.2 M/YEAR 2 TSENG-PA 16.3 M/YEAR			

FIG 1



SHORELINE PROCESSES OF AN-PING COAST

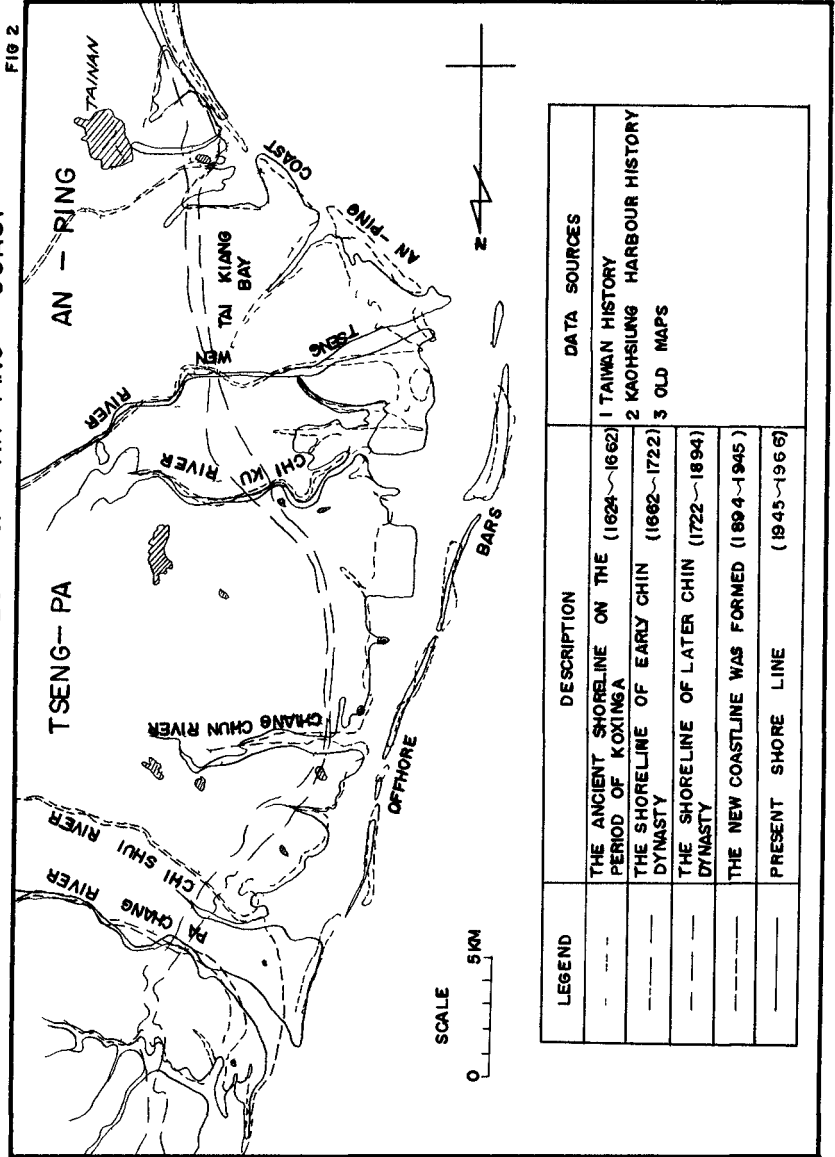


FIG 2

LEGEND	DESCRIPTION	DATA SOURCES
---	THE ANCIENT SHORELINE ON THE PERIOD OF KOXINGA	1 TAINAN HISTORY
---	THE SHORELINE OF EARLY CHIN DYNASTY	2 KAOSHUNG HARBOUR HISTORY
---	THE SHORELINE OF LATER CHIN DYNASTY	3 OLD MAPS
---	THE NEW COASTLINE WAS FORMED	
---	PRESENT SHORE LINE	

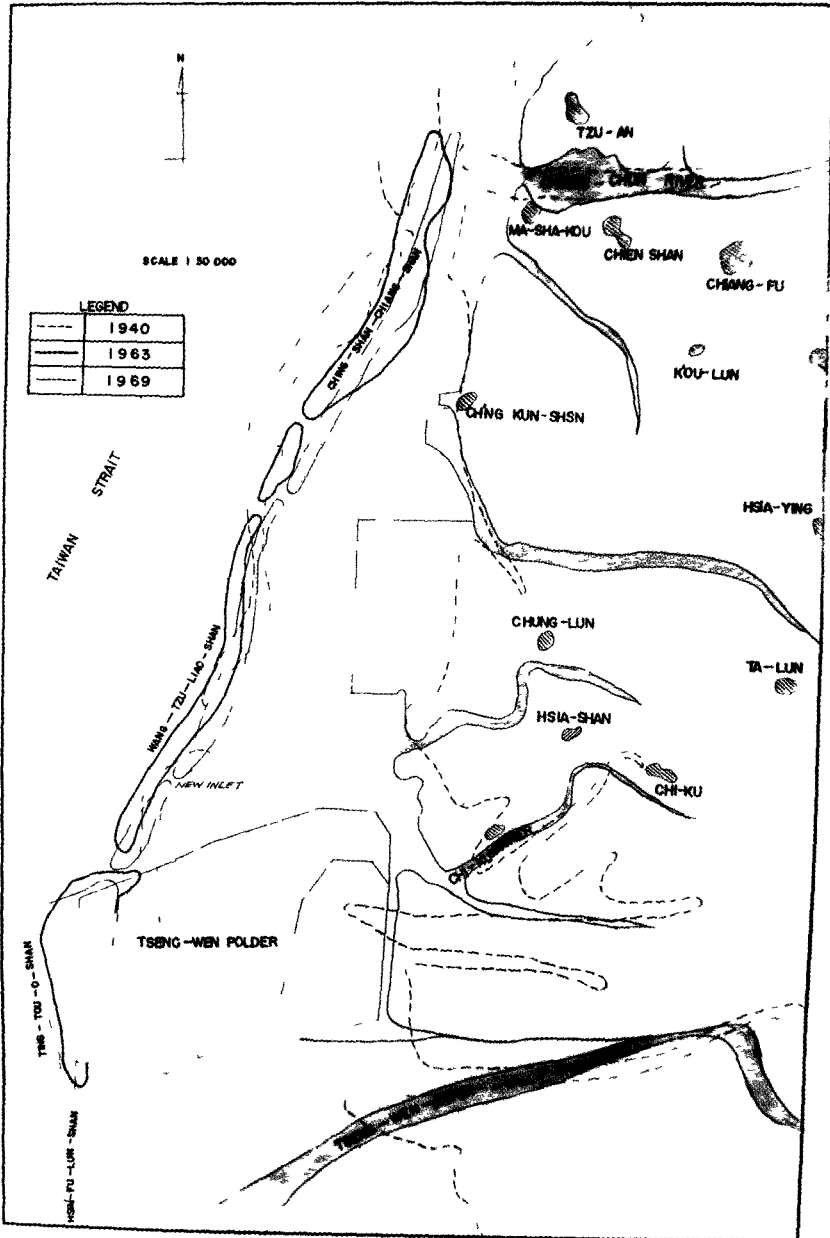


Fig 3 Map Showing the Variation of Shoreline on Tseng-Wen River to Chiang-Chun River

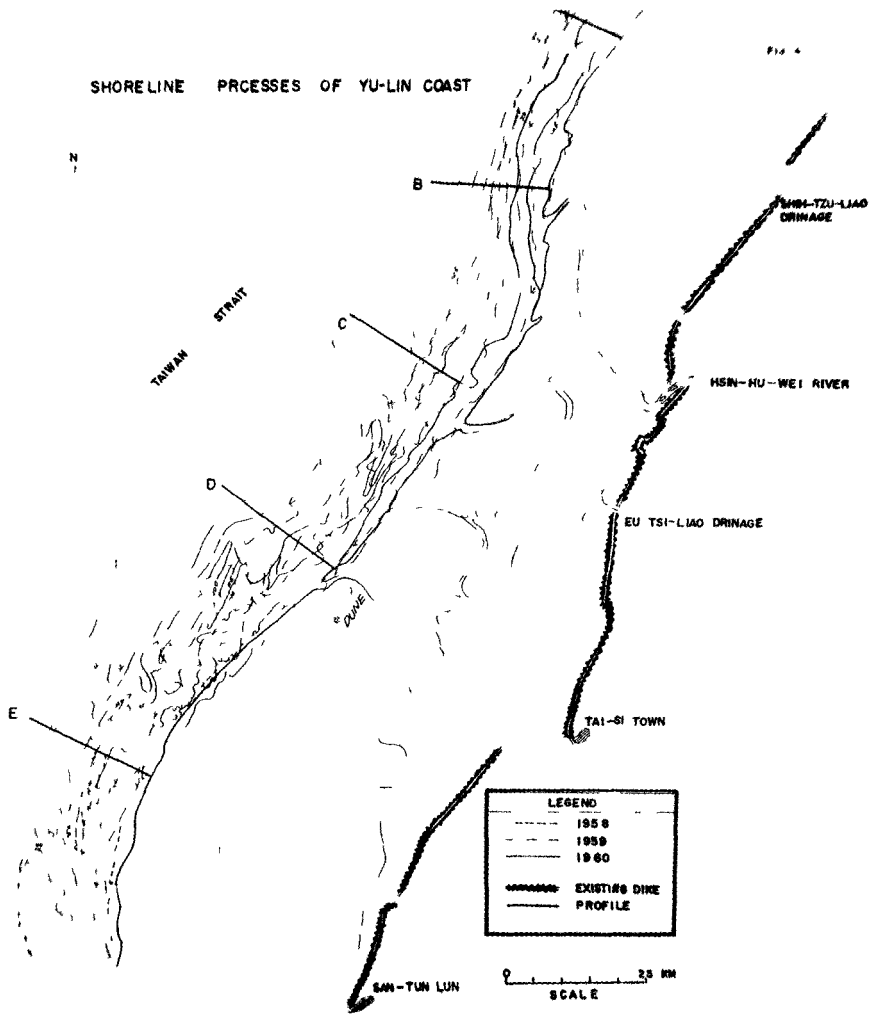


Fig 4 Shoreline Processes of Yu-Lin Coast

PROFILES OF YU-LIN COAST

FIG 5

