



Kaoping Shelf: morphology and tectonic significance

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Abstract—Thirty bathymetric profiles across the southwestern Taiwan margin reveal two distinct physiographic features: a shelf and a slope separated at Fangliao. The Kaoping Shelf northwest of Fangliao is the offshore extension of the Pingtung Valley, and the unnamed slope west of the Hengchun Peninsula is a part of the submerged southern Central Range. The Kaoping Shelf is a short, narrow and shallow shelf (100 km long, 20 km wide and 80 m deep). This shelf can be divided into two subshelves. The one to the north is terraced with an average width of 28 km and the other to the south is a very narrow (9 km) and shallow (40 m) platform. The average gradient (5 m/km) of the shelf is greater than that (2.5 m/km) of the average shelf worldwide. The width of the shelf, ranging from 7 to 40 km, increases progressively from southeast to northwest and is a factor of 2–4 narrower than that of others in the world. The gradient and width reflect the youthful stage of development of the Kaoping Shelf. The seaward progradation of the sediments from the coastal plain of the Pingtung Valley resulted in the prograding Kaoping Shelf, as suggested by cored sediment samples and seismic profiles. The morphology of the Kaoping Shelf depends mainly on the tectonic setting of the uplifted Taiwan orogen and the accompanying foreland-basin sedimentation. This young (less than 400,000 years) shelf is still growing and prograding southward in a parallel direction with the southward propagating arc-continent collision in the Taiwan region. © 1997 Elsevier Science Ltd

Introduction

Geological setting

The island of Taiwan is located at the junction between the Ryukyu Arc and the Luzon Arc along the rim of the Western Pacific (Fig. 1). The oblique collision between the Luzon Arc and the Chinese continental margin during the period from the Late Miocene to the present has resulted in the formation of Taiwan Island (Suppe, 1981; Ho, 1986; Teng, 1990). The collision is still actively propagating to the south (Suppe, 1987). Moreover, the arc-continent collision in the Taiwan orogen resulted in a foreland basin and a mountain belt in the west and east, respectively (Covey, 1984) (Fig. 1).

The western Taiwan foreland basin covers the hilly Western Foothill, the Coastal Plain and its offshore areas. This basin is mainly filled with Pliocene–Pleistocene sediments up to more than 5 km thick (Covey, 1984). The geological framework of the study area in southwestern Taiwan, including the Pingtung Valley, was established during Late Pliocene and Pleistocene. The Pingtung Valley lies between the Central Range to the east and a low hilly upland to the west. The N–S trending Chaochou Fault separates the Pingtung Valley from the Central Range. Tectonically, the Pingtung Valley is considered to be a foredeep related to the Manila Trench subduction zone (Biq, 1977). This valley is actively subsiding today (Ho, 1982). Regionally, the southwestern Taiwan margin is a growing foreland basin receiving sediments from the Taiwan orogen (Yu, 1993). The mountain ranges of Taiwan, including the prominent Central Range, are fold-thrust belts of Tertiary strata. They extend from north to south

throughout the island. The Central Range south of Fangliao is called Hengchun Peninsula (Fig. 1)

Previous studies

In their pioneering investigations of sediment properties of the shelf and slope around Taiwan Island, Boggs *et al.* (1979) pointed out that the shelf edge around the island can be placed at the 200 m isobath, which reveals a distinct asymmetry of the sea-floor topography around Taiwan (Fig. 2). It should be noted that the island of Taiwan is bordered by the shallow Taiwan Strait Shelf to the west and a deep-water (3–5 km) region of the Philippine Sea to the east. The width of Taiwan Strait Shelf ranges from 140 to 200 km and a major portion of the shelf is covered by water shallower than 60 m. Off the eastern coast, the shelf is very narrow and the sea floor descends to the 3000 m isobath no more than 1 km beyond the coastline.

Across the southwestern Taiwan margin, the sea floor passes a narrow shelf and descends to a depth of about 3000 m at the northern end of the abyssal plain of the South China Sea. Morphologically, the southwestern Taiwan margin is characterized by a very narrow shelf and a broad southwest-facing slope. Yu and Wen (1992) named the shelf along the southwestern Taiwan margin the Kaoping Shelf, characterized by narrow width and shallow depth. The Kaoping Shelf extends for about 150 km from the southern tip of the island of Taiwan to the Tsengwen Hsi River mouth, where it merges gradually into the broad Taiwan Strait Shelf (Fig. 2). This shelf was considered to be the natural prolongation of the Coastal Plain and the southern Central Range of Taiwan. Furthermore, Yu and Wen (1992) noted that a distinct character of this shelf is the marked change in