

Deformation front development at the northeast margin of the Tainan basin, Tainan–Kaohsiung area, Taiwan

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Abstract

The geological setting south of the Tsengwen River and the Tsochen Fault is the transitional zone between the Tainan foreland basin and Manila accretionary wedge in Southwestern Taiwan. This transitional zone is characterized by the triangle zone geological model associated with back thrusts that is quite unique compared to the other parts of the Western foreland that are dominated by thrust imbrications. The Hsinhua structure, the Tainan anticline, and the offshore H2 anticline are the first group of major culminations in the westernmost part of the Fold-and-Thrust belt that formed during the Penglay Orogeny. Structures in the the Tainan and Kaohsiung areas provide important features of the initial mountain building stage in Western Taiwan. A deeply buried basal detachment with ramp-flat geometry existed in the constructed geological sections. A typical triangle is found by back thrusting, such as where the Hsinhua Fault cuts upsection of the Upper Pliocene and Pleistocene from a lower detachment along the lower Gutingkeng Formation. The Tainan structure is a southward extension of the Hinhua Fault and has an asymmetric geometry of gentle western and steep eastern limbs. Our studies suggest that the Tainan anticline is similar to the structure formed by the Hsinhua Fault. Both are characterized by back thrusts and rooted into a detachment about 5 km deep. The triangle zone structure stops at H2 anticline offshore Tainan and beyond the west of it, All the structures are replaced by rift tectonic settings developed in the passive continental margin. On the basal detachment, a major ramp interpreted as a tectonic discontinuity was found in this study. Above the northeastern end of the major ramp of basal detachment, the Lungchuan Fault is associated with a triangle system development, while at the southwestern end a thrust wedge is present. It could be deduced that a thrust wedge intrudes north-westward. The area below the major ramp, or equivalent to the trailing edge of the basal detachment, mud diapirs often occur in relation to the thickest deposits of the Gutingkeng Formation and caused by the mechanism of detachment folding.

Introduction

The fold-and-thrust belt in the Tainan and Kaohsiung area, Southwestern Taiwan, extends from the foothills in the east to the Western Coastal Plain and offshore area (Figure 1). The location of the thrust front inland of Southwestern Taiwan still remains uncertain. Accurate structural styles and their distribution between the inland and offshore still present existing high ambiguity due to the thick mudstone of Gutingkeng Formation overlying the Miocene. Therefore, this study is focused on constructing detailed balanced cross and palinspatic sections by integrating interpretation of seismic, well, and field data together. This study area is also

located at the northeastern part of Tainan Basin. Overprinting of the compressional tectonics from the hinterland of Central Mountain Ranges resulted in the thick foreland mudstone cover over the pre-existing Miocene rift sequences, the deep structural framework of northeastern Tainan Basin is still a puzzle. A structural style and tectonic evolution of this area are proposed from previous documented studies (Figure 2). Generally, it is difficult to obtain good quality seismic data in the coastal plain in Southwestern Taiwan because of thick mudstone. But, in the offshore area of Southwestern Taiwan, the seismic data interpretation created from the exploration by the Chinese Petroleum Corporation and the survey by the Institute of Oceanography, National