



The Kinematic Model of the Foreland Basin Development in Northwestern Taiwan

YU CHUN CHANG, KENN MING YANG, and SHI CHUAN PENG

National Cheng Kung University, Faculty of Science, Earth Science, Tainan, Taiwan (c44971148@gmail.com)

Since the Early Pliocene, oblique collision between the Eurasian and Philippine Sea plates have formed the Taiwan orogenic belt, which tectonic load deflexed the rift-type continental margin and formed a foreland basin in western Taiwan. This study investigates the area covering, from north to south, the Kuanyin basement high and the Neogene extensional basin center. In this study, we attempt to reconstruct the tectonic subsidence history, propose an evolutionary model and investigate the effects of inherited tectonic unit on the later development of the foreland basin in northwestern Taiwan.

Lithofacies analysis based on outcrop data and lithologic logs indicate that, the environment had deepened in the beginning and then became shallow. However, in the next period, the environment started to deepen again and deep marine shales were deposited till the end of the period. Following that, thick coarsening-upward sediments continued to deposit till now. Isopach maps and tectonostratigraphy sections show gradually westward decrease of the stratal thickness, indicating the initiation of the foreland basin development with depositional center moving southward since that. Tectonic subsidence curves indicate time-spatial variation in tectonic uplift and subsidence in the foreland basin. During the period of NN12 (5.6-4.4 Ma), the entire study area mildly subsided. Following that, mild tectonic uplift happened in the offshore area during the period of NN13-NN15 (4.4-3 Ma), while the northern part of offshore area and outer foothills still encountered mild tectonic subsidence, forming a typical asymmetric shape of foreland basin. During the period of NN16 (3-2.6 Ma), rapid subsidence happened and further extended into the entire area of the basin, forming a broad and symmetric basin shape. In the next periods of NN17-NN18 (2.6-1.8 Ma) and early NN19 (1.8-1.6 Ma), tectonic subsidence rate decreased rapidly especially in the offshore area. After the period of middle NN19 (1.6Ma-present), only mild tectonic subsidence or uplift has happened in the distal area.

Based on the aforementioned results, we propose an evolutionary model of the foreland basin in northwestern Taiwan. During the period of 5.6-4.4Ma, the area of mild tectonic subsidence was still on the pre-orogenic continental passive margin. During the period of 4.4-3 Ma, encroaching orogenic belt started to impose tectonic load on the study area and caused mild uplift in the distal part while subsidence in the basin center of the foreland basin. The mild uplift and subsided represent the study area still in the distal part of the foreland basin system. During the period of 3-2.6Ma, rapid subsidence rate represent the foreland basin went into a more active stage, and the study area was already in the proximal part of the foreland basin system. During the period of 2.6-1.6Ma, decreased tectonic subsidence rate and the shallow water sedimentary facies imply that the orogenic activity gradually ceased and the foreland basin started to be filled up. Finally, from 1.6Ma to date, the orogeny reached a quiescence stage and the offshore environment changed to fluvial environment, indicating that an underfilled basin evolved to an overfilled one.